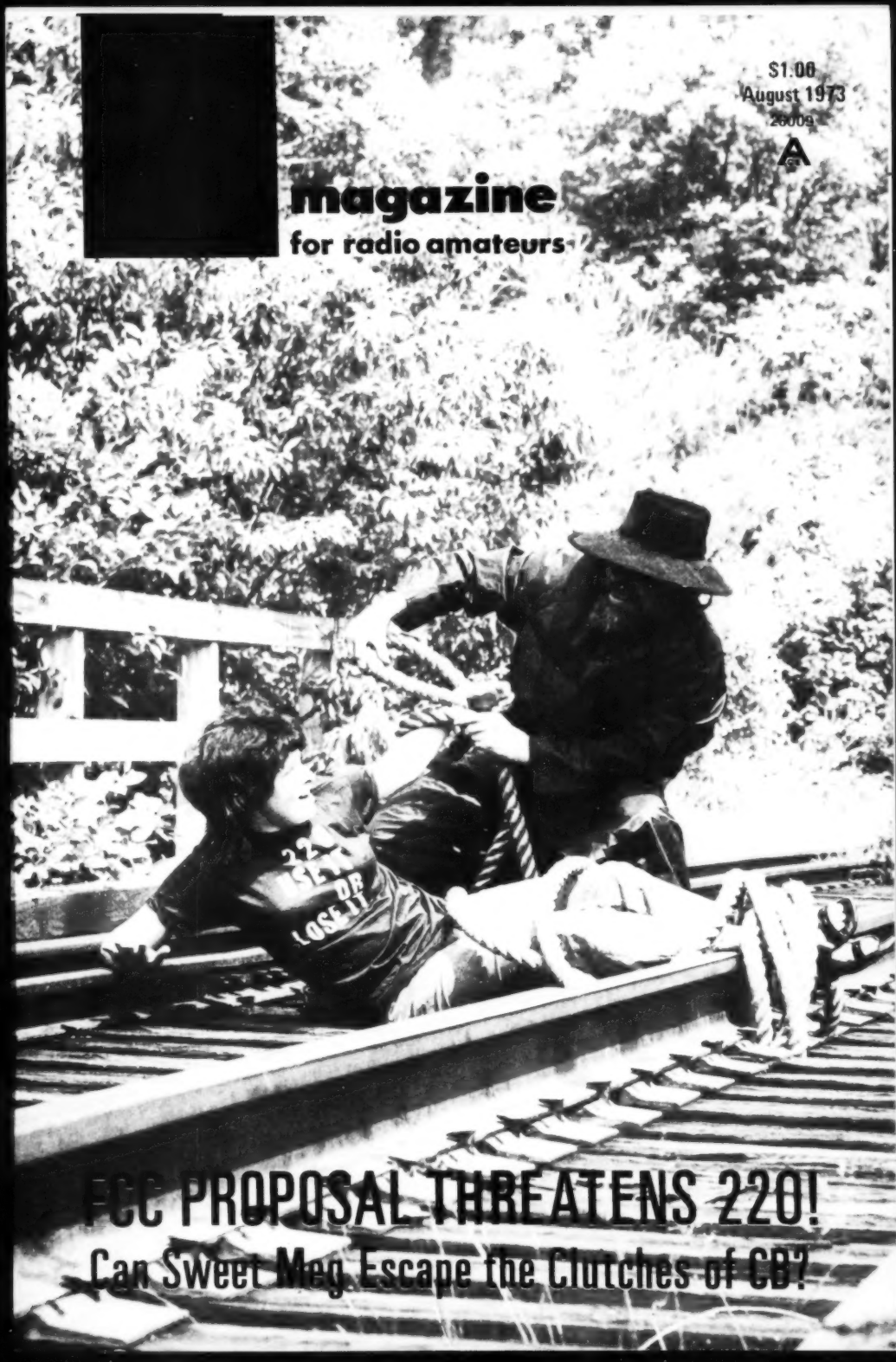
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magazine
for radio amateurs
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73 magazine
for radio amateurs

#155 AUGUST 1973

FEATURES

2 Never Say Die W2NSD/1
3 SSTV Scene
4 AMSAT News
6 50 MHz Band
7 DX Footnotes
8 Contests
8 Traveling Ham
9 Hamburglar
9 Looking West
10 Repeater Update
12 Social Events
13 FCC News
16 QSL Contest
6,16 New Products
42 Letters
92 Caveat Emptor
102 Circuits
127 Phase Lock
128 Propagation
128 Advertiser Index

21 Single Band Log-Periodic Antennas, Part I **W4AEO**
Easier than falling off a tower.

27 Squeaker for Tone Burst Entry **K9KIC**
Any tone - any time . . . one tiny chip.

31 VHF Power Amplifier Design **K6RAD**
If you remain unconvinced about building that amplifier, maybe you're holding the magazine upside-down.

37 220 Goes CB ..... **FCC**
A new game plan: Upgrade the Mississippi Blacksnake to Class E.

39 The Amateur's Intercom **K1CLL**
For duplex QSOs with the kitchen.

43 Novel 160 Meter Antenna **W2JKI,K2EE**
A wraparound antenna . . . remember the hula hoop?

45 Solid State SSTV Monitor **WB8DQT**
Features magnetic deflection, noise immunity, tuning indicator—here's the monitor you've been waiting for.

57 Low Cost Frequency Counter ..... **Harper**
A counter like any other . . . but this one is cheap.

63 VOM Design **WA3JBN**
A simple VOM with cheap available parts.

65 QRP Transmitter **WB6BIH**
Get that 1609.344 kM per Watt award with this simple two transistor rig.

69 The Numbers Game: DXCC **WA9VGS**
Where do you fit in the charts?

71 Solid State Exciter for 450 MHz **K1CLL**
K1CLL rides again.

79 Talk Power and FM **W2EUP**
Don't forget to give a 10-count while you read this article.

87 Amateur Rules and Regulations, Part III ..... **FCC**
This month the Ancient Mariner fearfully eyes the 220 Albatross on page 37.

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The recent Walkergate scandal has just been compounded by the FCB proposal to create a new Class E Citizens Band in the top Megahertz of 220—225. Does the FCB seriously think that a one Megahertz sacrifice will soothe the Citizens Blasphemous? Pictured on the cover is Jane Lake, our 220 girl of the month, being attacked by KDK-2573. Can she be saved?

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EDITORIAL BY WAYNE GREEN

CB ON 224?

You want to know my reaction to the FCC docket? Frankly I think it's a bunch of crap.

The Commission set up the 27 MHz citizens band in the form we have it today and it is obvious to me that they don't give a damn about what is going on there. The FCC has had plenty of opportunity to do something about the mess if they wanted to – but they don't want to. Politics. On the one hand is the heavy arm of the Electronics Industries Association (EIA), the well-funded Washington lobby repesenting CB manufacturers, and on the other is a very vocal group of a million or so people who like what they are doing and see no reason why they should stop – and this means hollering like hell to their congressmen whenever they have a bitch.

So Walker (Prose Walker), the Chief of the CBers, shrugs his shoulders and mumbles about not having the money for enforcement, and the official monitoring stations send out more pinko tickets to hams than they do to CBers. The Commission explains this inequitable system on the basis that, well, hams pay attention to the citations while the CBers just tear them up in anger and ignore them.

Don't you think for one moment that Walker couldn't put the screws to the CB gang the same way he has the hams if he wanted to. He doesn't need a thousand more monitor engineers to do this. The fact is that the FCC has had some very good ideas about what to do to put a stop to the massive violations on 27 MHz, but has flatly refused to carry through with them. Politics.

At one time the FCC was about ready to get started on an organized plan to attack the problems of CB. They were going to get an enforcement group together and move from city to city, issuing massive citations. When spread out all over the country there is little they can do to curb the lawbreakers, but when concentrated in one spot, they could really cool things. The press of the country was behind the idea and looking eagerly to the headlines it would make. It never came off.

The fact is apparent that the FCC is afraid of CB.

So here we are with the Commission about to open up forty more CB channels. They are about to do this even though it means breaking the ITU regulations which limit the 224–225 MHz band to amateur and radiolocation. They are about to do this because they know that they will have less political pressure if they do it.

CB has muscles. The EIA has good connections in Washington, while amateur radio has no lobby and a virtually silent ARRL. Amateurs don't have a low profile in Washington, they have none at all. CBers and CB groups get angry and fight for what they want – hams merely shrug their shoulders and look hopefully at Newington, telling themselves that the League knows what is happening and after all, it's their job to protect us. CBers are most fortunate not to have a League. Without this placebo they realize that they have to fight their own fights and they take the bit in their teeth and raise hell.

No one likes the bearer of sad news. Ghengis Khan used to fill messengers full of sand and return them to their masters when they brought him bad news. The fate of the present day harbinger of gloom dies a slower deather perhaps, but the reaction is enough to keep most magazine editors from leveling with you about how things really are.

The bad news I'm bringing isn't so much the start of an organized gobbling up of a ham band – did you think that CB would stop at 40 channels on 224 MHz when there are 160 more sitting there to take from us? The bad news is that we amateurs have for some reason chosen not to fight for our hobby and for the service it provides.

It doesn't take a whole lot of fight. You don't have to put your life on the line or anything. You just have to say dammit, no! Look what happened to Walker when the repeater groups got their backs up – he backed down. The sad part of that is that Walker was able to grind FMers so far down into the mud before they began to get angry and fight back.

As near as I can figure the antenna pattern requirements for the repeater licenses, Walker had in mind getting some free research data for a project he has been working on for several years. When I came up with the plan for getting standard antennas accepted he fought it as long as he could and then had to give in.

So what has docket 19759, the CB on 224 MHz scheme, got to offer us amateurs? True, it will probably bring us a lot of junky radios we can use in what is left of the band, until they take that away. If the stuff they turn out for this band is as great as the 27 MHz garbage, we're in trouble. How many of you have tried to use a CB rig on ten meters? Well, it won't be that bad, of course, but still a $100 transceiver is going to be marginal in usefulness.

(W2NSD/1 continued on p.18)

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

LICENSE FEES

Initial License	$ 9
Renewal	$ 9
New Class	$ 9
Modification	$ 4
Special Call Sign	$25

Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

Last month I briefly mentioned Robert's (W9LMD) Slow Scan keyboard. Since that time, Robert completed his 230 page college dissertation and was thus able to attend the Birmingham AL convention. So we managed a firsthand look at a direct fast to Slow Scan converter and SSTV keyboard. The keyboard is completely self-contained (excluding power supply) and its pc boards (containing a MOS character generator, IC, some memory ICs, some clocking ICs, etc.) are mounted below the 6x12 in. surplus computer keyboard. A message, ID, or whatever, (up to 5 rows of characters, 6 characters to a row) appears across the screen as it is typed out and persists there indefinitely until the "memory erase" button on the keyboard is pushed. (The clock "reads" out of memory, info which is then applied to the character generator IC driving a VCO at SSTV standards.) There are also keys which allow checking sync, black and white frequencies. The characters may either be read out as black on white, or white on black. The XYL really enjoyed hammering out different messages on the unit. (While remembering to count 6 characters to each line). After that she tried mastering diagonal ID's with horizontal words in the picture corners . . . let's see . . . 2 letters, count 3 spaces, 3 letters, count 1.

What a blast! I remember the first time a message came out "split" on the screen, she declared "That thing made a mistake!". Imagine interfacing a keyboard system like this to your SSTV setup. As each picture is presented, you could type out a description over the picture. Imagine also how handy this could be during contests. Robert's unit cost approximately $100 in parts, and took about a month to build, so I suspect when and if such a unit became available commercially, the cost would be equivalent to a Slow Scan camera. However, this speculation is based on "chip" cost today. Robert may write a full article on the keyboard soon.

The emphasis on moving Slow Scan activity higher in the 20 meter band is becoming quite apparent. We are finding quite a few of our SSTV friends around 14.240 kHz and very little, if any, Slow Scan activity below 14.230 kHz. The basic plan, remember, is to "stack" toward the high end of the band, rather than the low end. The 14.200 kHz to 14.230 kHz region is basically "prime DX" frequencies and Slow Scan activity here generally causes QRM to both DXers and SSTVers. The next time you're looking for a clear frequency, check the .230 to .250 region, and let's get activity jumping here. You can also help tremendously by passing word on this info to other SSTVers.40 meters is doing very well on the SSTV scene also. We've noticed quite a few of the gang around 7171 kHz, the new 40 meter "gathering" spot. This band shows real promise for use during the winter, so let's use it!

An interesting new item displayed by Robot at Dayton this year was their Fast Scan "Viewfinder" (for use with their Slow Scan camera). Although I didn't take time to look inside the unit, the operation appeared very nice. Motion was visible, thus reducing focus time on the camera. A faint line was visible moving in the picture, which indicated the initial trace line of the Slow Scan picture. This seemed quite handy for us in making up smooth "programs."

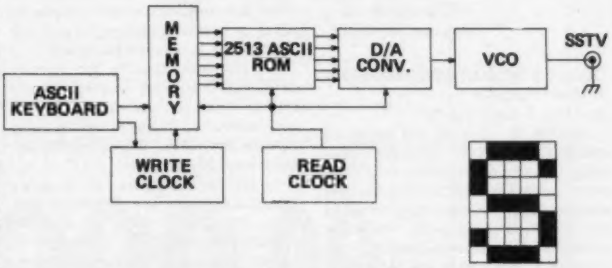


Fig. 1. SSTV keyboard/titler. The computer terminal industry has produced a number of IC's which, when scanned properly, are able to draw alphameric characters on the CRT screen. One such IC, the Signetics 2513 (@ $12) makes a good design center for an SSTV keyboard. Some memory IC's, some clocking IC's and a surplus "computer" keyboard wired for ASCII will make a unit invaluable for contest work, sequence tape titling, CQ'ing, satellite work, etc. The 64 different possible characters are simulated by inputing a 6 bit ASCII code for the desired character, and then scanning through the output 5 x 7 dot matrix at proper times, interfacing this output to the SSTV VCO. The keyboard can also run on fast scan by using a faster read clock approximately 1 MHz in frequency instead of the SSTV read clock of 960 Hz.

Another advantage of the Fast Scan monitor was its brightness. It's difficult to see pictures on the Slow Scan monitor with bright camera lights on, and the "Viewfinder" overcomes this problem. Another surprise from Robot is the modifications to their cameras. The front panel Scan reversal switch now controls a video inverter for nice black to white reversal techniques. Also, a small 3-position switch has been added to the rear panel for selecting 1/4, 1/2, or full frame scanning.

The Robot model 80A and the J&R 500 cameras incorporate slightly different ideas in their partial frame scanning, and this seems an appropriate time to discuss the difference. Using 1/4 frame scanning, both units scan only the top 1/4 of the subject material in front of the camera. The Robot inserts a sync pulse after each of these 1/4 frames (every 2 seconds), the J&R does not. The net result is the Robot 1/4 frame picture is presented on the top 1/4 of a monitor screen, and the J&R 1/4 frame picture is presented 4 times (vertically) on a full screen. Bear in mind that 'MXV monitors' noise immunity circuits are only open to vertical sync pulses every picture "bottom" and thus it will not reset to the "top" every 2 seconds. Both units are superb, however.

I receive quite a few inquiries asking where one can find pc boards for Slow Scan monitors. Here is a brief rundown. W6MXV, Mike Tallant, has either boards or kits available. 2 boards required. About $10 each. Taggart WB8DQT has an article this month in 73 on his new magnetically deflected monitor. He also is planning to sell boards on this monitor. 1 required. About $10 each. Gailek Solid State, 34 W. 13th St., NYC. The full story on this monitor was in June *CQ*, 1973. I do not know their cost.

Finally, I am having some problems with mail, and should you not receive an answer to correspondence with me within a week or so, try sending the mail through *73 Magazine* office. This works very well so far.

I have just received from Franco I1LCF, the following results of the 3rd Worldwide Slow Scan contest. Franco adds since there was such widespread use of SSB by SSTVers, he has not compiled a general score but

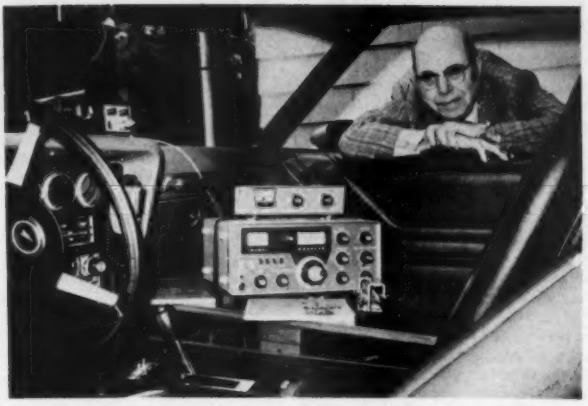
rather a listing of entries received (possibly more info will be available by next month). The entrants are listed below:

CT1PG	I5BNT	SM5CLW
DJ0CN	I5CW	PY1DCB
DJ9NG	I1RUB	VE1TV
DL1NI	IS0PEM	VD3GMT
DL2RZ	IT9ZWS	K4TWJ
EA4DT	OD5HC	W6YFT/7
FO8DO	OZ1AT	W7FEN
HA2KRB	OZ2LW	W9NTP
HA5KFA	SM4MI	W5GQV
I5BNT	SM4FT	

S.W.L.

HA5091 ON5UK/ON5EX

...K4TWJ



W2GN operating position in car. W2GN is frontrunner in OSCARmobiling with his very neat mobile setup on the passenger seat of his car.

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

OSCAR 6 OPERATIONS SUMMARY

A Guest Editorial
by Perry I. Klein K3JTE

OSCAR 6, first in the series of AMSAT-OSCAR-B missions, continues to operate satisfactorily after seven months in orbit. During the first week in May, the operating schedule was modified making the translator available for communications on Thursdays, Saturdays and Mondays, Greenwich Mean Time, and OFF on other days. The purpose of this change was to subject the nickel-cadmium battery to shorter, more frequent charge-discharge cycles. This procedure appears to be working well, and may well extend the useful lifetime of the spacecraft.

The temperature of the battery, which had risen to as high as 47° C. (117° F.) in early February and had been a cause for concern, has now dropped to a more comfortable value. There is now no reason to believe that we will not achieve the one-year planned lifetime, and possibly even exceed it, although we may find it necessary to further modify the operating schedule from time to time in an attempt to extend OSCAR's operating life to the maximum possible.

As many of the users of OSCAR 6 have noticed, we have initiated AMSAT official bulletin transmissions through the satellite translator, and these are generally given on the reference orbits (the first orbit of each Greenwich day, the same orbit during which the satellite is turned on briefly for telemetry recordings on the OFF days). VE2BYG, K1HTV, W3TMZ and K7BBO have been serving as AMSAT Official Bulletin Stations for these transmissions, which include reports of special experiments and any changes in the operating schedule.

We can now identify the calls of some 1,100 stations who have made one or more contacts via OSCAR 6, very nearly half of these stations being outside the USA. These include stations from 59 countries.

In the United States, all 50 states except Louisiana and Nebraska have been on at one time or another, although more activity is needed in Idaho, Kentucky, Montana, Nevada, Vermont and Wyoming, as only spotty activity has been reported from these states. The number of stations on from each of the U.S. call areas is W1: 38; W2: 64; W3: 47; W4: 64; W5: 34; W6: 91; W7: 53; W8: 30; W9: 61; W0: 52; KH6: 2; KL7: 5.

The operator apparently leading with the most reported satellite contacts is K7BBO with over 3,300 QSO's (Dave is averaging about 500 satellite QSO's a month), and several stations now have over 45 states confirmed through the satellite.

We have one report of operation from VE8, and activity in Africa; South America and the Far East also seem to be very sparse. We urge members in these regions to equip for satellite operation during the coming months.

A special message commemorating World Telecommunication Day was transmitted over OSCAR 6's Codestore message storage system on May 17 using the 29.45 MHz beacon.

The first reported aeronautical mobile communication via OSCAR 6 was by W6OAL, who reported working K7BBO April 27th on Orbit 2431 over a distance of approximately 5,000 miles. The transmitter aboard the aircraft was a Gonset Sidewinder operating on SSB with less than 5 watts PEP to a simple whip antenna.

W2GN for the past several months has been quite successful with an automobile OSCAR terminal, and has been very popular with his special state DXpeditions to Vermont and Kentucky to put these rare states on the air. AMSAT is encouraging more mobile terminal operation with OSCAR 6. In particular, operation from small private aircraft, small boats and automobiles (especially on SSB) would provide a very effective demonstration of the usefulness of amateur satellites for small-terminal communication. In addition, operation using totally hand-held equipment or operation from a bicycle or motorcycle would be impressive "firsts," and we urge anyone interested in these activities to give it a try. If possible, make tape recordings of some of the mobile contacts and send them to AMSAT, P.O. Box 27, Washington DC 20044.

WB8LBP

Early QSL's of W2GN.

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50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

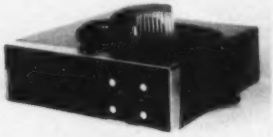
8P6EN is still very active – WB4BND reports the beacon *is* operational on 50.103 from 2130Z to 0030Z weekdays and as time permits over the weekend. Alan has been heard but not worked from the St. Louis area . . . KH6EQI has been worked as far east as Colorado – ask WAØIQN about it. A new Idaho station to look for is WA7FSI. This should relieve some of the pressure on Keith W7UBI. Keith was very much in evidence during the contest. VP2LAW is looking for a Yaesu FTV-650 transverter, and with a little luck will be on the air by the time of publication.

Roberto TG9SO is operating from Guatemala City with a Swan 250 and a pair of 5 element beams. K8REG is now W7JRF/7. WB2TIY is running SSTV on 6 – he was heard (seen) the other evening on 50.150. W7JNK is now signing portable 5. Jim WB4UJH will be running a beacon on 50.105 from Winston-Salem. Whatever happened to Pete VE8BY? WB5FUL says he runs 12 watts of AM to a 3-element CushCraft on 50.42, 74, 55, 70 and 51.45. WA1EXN says Maine had Es openings 8 of the last 9 days of May. Art worked Andy VE4MA twice on the 27th. Hamp K5EFW has been heard here every day for weeks, including while he was working KP4's.

If you don't care for the distortion introduced by the noise limiter in your SB-110, try replacing C54 and C55 with 200 pF capacitors. The limiting action is just as good and the fidelity is greatly improved. There is, by the way, an error in the manual as to the value of these capacitors. The schematic indicates .005, while the construction step says .01.

The early hours of the June contest were almost a complete flop in many areas. Very little Es was noted, leaving only the high power modes to keep things rolling. Scatter and groundwave provided most of the activity. Isn't it amazing how well these modes work when we are forced to use them? Around 2130Z Sunday a reasonable quality aurora improved the situation . . . then another lull. The high point of the weekend was one of the finest Es openings in the memory of anyone. Around 0200Z Monday the band opened from Ohio and Kentucky in the east to California, Oregon, Washington and British Columbia in the west. I have personally never experienced an opening as intense as this. Oldtimers agree there has never been one like it before. W7FN, W7VDZ, W7JRG and a number of others pinned the "S" meters at 60 over 9 for over 4 hours. Fantastic! I might mention that at the same time stations in Indiana, Georgia, Mississippi and points east could be heard reasonably well. Only the severe QRM from the super-loud West Coast prevented more good contacts in that direction.

LINEAR SYSTEMS SBE-50



The SBE SB-50 "SIDEBANDER 6" is an all solid-state 6 meter (upper) SSB and AM transceiver. Frequency coverage is from 50.050 to 50.280 in 23 switched segments of 10 kHz each. The heterodyne oscillator is a frequency synthesized arrangement of 10 crystals combined with the 7.8 MHz i-f to produce the frequency range mentioned. One switch selects the proper pair of crystals to provide any frequency within this range. To cover the frequencies between the 10 kHz points, one of the crystal oscillators is pulled ±3 kHz. This control is labeled "RIT." Turning the RIT control to the extreme counterclockwise position switches off the RIT feature and locks the receiver and transmitter together.

Squelch is provided with a front panel control to set the operating point. At first I thought this was a useless item, but believe me it isn't if you are the type who leaves the rig on for long hours listening for an opening. The only other panel control is the receiver af gain. On/Off, AM/SSB and Noise Blanker In/Out functions are controlled by push-push variety push buttons. Also on the panel is an illuminated meter which reads signal level to 30 over 9 in receive and relative output in transmit.

All tuned circuits normally tuned by panel controls have been broadbanded. This allows instant operation within the stated frequency range without the bother of peaking, tuning and loading. As could be expected there is some compromise involved, but in this case the difference from one end of the range to the other is no more than 3 dB with maximum sensitivity in the normally utilized midrange. The transmitter output variation could not be noted on the wattmeter. Output on SSB was measured at 10 watts, and the AM output half that. Signal reports over a two-month period averaged about 2 "S" units (or 12 dB) down from the parallel 6146's in the rig used for reference. Alc is included in the transmitter.

The receiver is excellent; good enough, in fact, to make me suspect there was something wrong with my regular rig. There wasn't. The rig was loaned to KØRIR for several weeks so I could hear it and Don experienced the same situation. This rig hears better than I thought was the state of the art.

While intended to operate from an automotive electrical system, it can and was used at the home station with the addition of a small 3 ampere, 12 volt supply. The mobile intent is obvious in the amount of af output available for masking background noise and the lack of VOX circuitry. The noise blanker works extremely well on ignition noise. On SSB or AM, turning on the blanker in the presence of high ignition noise levels produced a full and complete removal of all evidence of the noise. In a rig intended for operation in an automobile this is a necessity to my way of thinking – you will not be disappointed.

There will be those who question the power output level. For Es and local ragchews 10 watts is perfect, but for scatter or groundwave it is somewhat lacking – for that matter so are the 200 watt transceivers. If anything, 10 watts is a more reasonable output level, perfect for driving a linear without swamping loss, and I might add that I experienced no TVI on a cheap, unfiltered TV which goes bananas when my old rig is keyed.

The quality of design, components and workmanship are first class in all ways. The component side of the single PCB is silk-screened with every designation and all internal controls are clearly marked for ease of adjustment, should you ever feel the need. The size and weight remind you of 2 meter FM. Does it sound as if I like the SB-50? It should, because I do.

WAØABI

Even the British Government is trying to get into the act via a recent poster! TNX G3TVI

By, Gus M. Browning, W4BPD
Drawer "DX"
Cordova, S.C. 29039

Here we are right smack into summertime and from all I can hear the real serious low frequency DX'er is still working DX on both 160 and 80 also on 40 meters. 10 has more or less "had it" this summer and 15 has even got a little "shaky" as far as rare DX is concerned. Those Ole Sun Spots is gradually catching up with us I would guess. Even the CB gang has complained that they are not working "skip" very good now. (this makes me very sorry for them!)

Now is the time to do whatever you have been "thinking about" doing all winter with your antenna or antennas because it will soon be fall and then winter again, and you will never get it done.

Did you ever want a great circle chart from your QTH ? Well it is now possible to get one for a measley $ 1.00 worldwide or via air mail for $ 1.75 if you send it to:
WB5CBC, William D. Johnston
1808 Pomona Drive
Las Cruces, New Mexico 88001
Give him your name and address.
The city for which the chart is wanted.
Include your state or country too.
If the population is less than 10,000 or if the location is a rural area also include the latitude (indicate north or south) and longitude (east or west) in degrees and minutes. (phone your local airport or some surveyer).
Charts are centered on more than 2,000 cities and towns. 660 DX points are given in degrees from true north. If you use a rotary beam this will help you point it the right direction.

I have received many complaints on the Mt. Athos DXpedition of a few months ago (probably from fellows who didn't get a contact ! ?.) The biggest complaint seemed to be their selection of their SSB frequency on the 20 meter band. When they were on 14200 and using TRANSCEIVE the fellows were in "trouble", if they operated a few kc up inside the W part of the band they didn't get a contact, if they got on 14200 they may have got a contact from both FCC and the DXpedition ! I myself didn't hear any of the operation, I am only reporting the dope I received from some of the gang. Their 40 meter CW operation was good and that's where many fellows got their Mt. Athos QSO. I would very strongly suggest that DX stations either get up very definitely INSIDE the W/K part of the bands if they are "stuck" with a transceive deal, but BY FAR it's much better to get WELL OUTSIDE our part of the band and USE SPLIT frequency. Of course if you can handle the gang in the pile-up and get them to OBEY your instructions (if they hear them), then (in a push), use your transceiver and good luck to you, but GIVE ME SPLIT FREQUENCY every time, because when I have went to all the trouble to be DX, I WANT LOTS OF QSO'S-FAST !

XV5DX - Anyone know if this station is actually in Viet-Nam for sure ? He mentioned QSL via K9VF. I have my "doubts" about the whole thing, BUT, I might be wrong. Good luck to you who got a QSO, I hope he was good and I hope you got his QSL (but I doubt it !)

Then there was another station on signing XV5AD - I don't know "nothing" about him either - DO YOU ?

What is DX anyhow ? My answer to this question is very simple. It's any country that YOU have not worked. While I am on this subject of what's DX - Sure would like to get a list from EVERY READER of the countries he need to have "worked all of them". This would help Peggy and I to more or less "select" where we should go on our next year's DXpedition (funds permitting, of course,)

SIKKIM - I wonder if anyone knows what's happening up there since their "big trouble" this past spring ? Sure hope the Maharaja and Maharanee are doing well. They are such fine people and I am sure he would like to fire up AC3PT again, and so would thousands of DX'ers.

BHUTAN - A51PN was trying for his WAS last spring. In April he still needed these states for WAS: Alabama, Alaska, Arizona, Colorado, Hawaii, Idaho, Iowa, Kentucky, Louisiana, Maine, Maryland, Mississippi, Nevada, New Hampshire, North Carolina, Rhode Island, South Carolina, (wish I had up a good beam and some decent power !), Vermont, Wyoming, He hangs out around 14070+– and has been worked from starting 1200z.

CHINA – According to the info I received in late spring they are starting what's called an "Amateur Radio Service" in the Peoples Republic of China. The call signs will be BD1 - BE1 - BF1 etc. All sounds OK since the calls are in the right block BAA to BZZ for China. Sure will be FB, writing down in your logs such places as Sian, Peking, Hangchow, Lanchow, Shanghai, Canton, etc.

THE LACCADIVES: Anything "cooking" from over there lately ? Must be about time for one of the VU2 boys to hit this rare spot again and get some "action" going on the bands again !

HAVE YOU A SECRET METHOD OF GETTING THAT RARE QSL ? Wanna spill the beans to me and I will tell the boys about it and it wont be a "secret" anymore - This I promise you for sure.

WTW AND 73-73-73 AWARD: Yes we are giving out these two awards. Work 100 (or more) countries, get a QSL from them, send me your cards (via registered mail or at least certified mail) and $ 1.00 if you want them back ! Or send them to our nearest Verification Point for your area (we have a few). We will do the rest and get your certificate off to you. THE 73-73-73 Award is easy to get. Check your logs for 73 worked countries in the first 73 days of 1973. Get three hams or a ham club to verify your list, send it to me along with $ 1.00 to help with expenses, I will do the rest Ole Buddy. This is a "once per lifetime" award since the year 1973 is 73 Magazine's year we want to let the radio world know about it by issuing these 73-73-73 certificates (Wayne Green said, "This is OUR YEAR", and I believe him ! (write him a "nasty" letter if you don't agree with him, he likes to get plenty of mail, ANY KIND !

Any of you who knows of any DX event that's planned a few months in advance how about dropping me a note so that I can pass the info to the gang. Sure would appreciate it a lot. Or maybe you have other info little DX tidbits that you think the fellows would like to know about. Little items like these are always needed and appreciated here. Thanks.

FOR A BETTER QSL RETURN: I have been told that the COLOR of your QSL card has a bearing on the percentage of cards answered ! At first this made me laugh out loud. In fact I still think someone is trying to "pull my leg". I wonder if some of you out there can verify this story, one way or the other ? I am sure though that if you have a nice fancy card, maybe one showing the room full of pretty, expensive gear, a big, expensive looking house, a nice list of the gear you use, a big antenna etc. You had better not send this kind of card to certain countries, especially those that have a central bureau. They will somehow become "lost" along the line and if the station is one that only answers QSL cards you are stuck - NOT UNLESS you have a few cheap looking cards to send out. A card with just the smallest amount of info on.

Gus BPD

CONTESTS

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

CONTESTS

Aug 4-5	Illinois QSO Party
Aug 18-19	New Jersey QSO Party
Aug 18-19	QRP ARC Contest
Sep 8-10	Four Land QSO Party
Sep 15-17	Pennsylvania QSO Party
Sep 29-Oct 1	Delta QSO Party
Oct 6-7	New Mexico QSO Party
Oct 13-14	RSGB 21/28 MHz Telephony Contest
Oct 20-21	RSGB 7 MHz CW Contest

THIS MONTH

Illinois QSO Party

Complete rules appeared in last month's "Contest Calendar." Your editor finished first in Ohio in the 1972 contest.

New Jersey QSO Party

From 1900 GMT August 18 to 0600 GMT August 19 and from 1200 GMT to 2300 GMT August 19. Phone and CW are the same contest. A station may be contacted once per band and once per mode. Suggested frequencies are 1810, 3535, 3735, 3905, 7035, 7135, 7265, 14035, 14280, 21100, 21355, 28100, 28600, 50–50.5, 144–146. Exchange QSO number, RST and QTH (ARRL section or country, or county for N.J.). For non-N.J., multiply total QSOs with N.J. by total N.J. counties worked. For N.J., W-K-VE-VO QSOs are 1 point; DX count for 3. Multiply total QSO points by total ARRL sections. (NNJ, SNJ count as sections too.) KP4, KH6, KL7, KZ5 count both as 3 point QSOs and as section multipliers. Appropriate certificates. Logs must show GMT date and time, band, mode, exchanges, and scoring. Logs must be received no later than September 15, 1973. Miscellaneous: Indicate and number the first contact for each claimed multiplier, and attach a check sheet of QSOs and multipliers. Multi-op entries must show calls of all participating operators. Mail logs and comments (and a size No. 10 SASE if results are desired) to Englewood Amateur Radio Association, Inc., 303 Tenafly Road, Englewood NJ 07631.

QRP ARC Contest

From 2000 GMTAugust 18 to 2400 GMT August 19, 1973. Open to all hams. Call "CQ QRP." Exchange RS/T, State/Province/Country, QRP number if member (non-members send "NM"), and Power. Stations may be worked once per band for QSO *and* multiplier credit. QSOs with members are 3 points, QSOs with non-members count 2. Power multipliers (output power) – more than 100W (200 PEP) – X 1, 25 to 100W – X 1.5, 5 to 25W – X 2, 1 to 5W – X 3, less than 1W – X 4. Multiply total QSO points by total States/Provinces/Countries on each band, then multiply by your power multiplier. Suggested frequencies are 3540, 7040, 14065, 21040, and 28040 kHz on CW; 3980, 7280, 14330, 21430, and 28600 on SSB. Novices try 3715, 7115, 21115, and 28115. Appropriate certificates. Send full log data, including band, equipment, power input/output, and a signed statement that contest and government regulations were observed. Log deadline is September 25, 1973, and logs go to Jim Hadlock K7JRE, Contest Chairman QRP ARC-I, 3701 S.W. Morgan St., Seattle WA 98126.

Well, gang, the column seems to be coming along rather nicely. Next month we will report on five big contests and possibly more than that. Judging from comments so far, this column is a welcome addition to 73. If you have any comments of your own, or questions, feel free to write. If you have info on an upcoming contest that you would like to see announced here, please get it to me 3 months prior to the date of the contest at the very least. Correspondence should go to Tom DiBiase WB8KZD, 708 6th Ave., Steubenville OH 43952.

WB8KZD

Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

The first night that we spent in New York City, the locals welcomed our car by removing the gas tank cap. Perhaps that was my fault for putting temptation in their way by parking my car with its out-of-state plates on the main road through the campus of Yeshiva University in Washington Heights.

Luckily I had some "green tape" in the car, and was able to repair the damage so well I was able to drive around the city also return to Washington in the rain. This green tape is made by "Scotch" and is almost the same stuff that the astronauts used on the moon. It is also very useful here on earth in the mobile station for holding rigs and cables in place. It also makes great insulating tape. It is also useful in covering holes in the car and supporting parts that are about to fall off. When covering the gas cap hole, put a piece of paper over the hole under the tape because the petroleum fumes may dissolve the adhesive in the tape and it may end up in the engine.

After the gas cap episode I did not trust the locals. I even took the AA10 amplifier out of the car as well as the TR-22 each time I left it, instead of tucking it under the seat as I normally do. They could have the car, but the rig – never!

New York City is a friendly place, at least to visiting hams. There is lots of activity on two meter FM. While there over a holiday weekend I was able to work through repeaters on 34–94 (Greenbrook NJ) 28–88 (Staten Island), and 25–85 (Long Island). WR2AAA in Manhattan is on 147.73 in, 146.74 out, so having borrowed 13–73 from W3ATE I was able to listen but had to remain silent. NYC also has a 16–76 machine with autopatch, but it needs a PL tone for access.

The XYL and I drove to the Skyscraper City from the Nation's Capital. As we drove, we worked through a number of two meter repeaters. The 28–88 repeater in Greenbelt MD is workable while driving along I-95 from the Washington Beltway to the Baltimore Beltway using nothing more elaborate than a TR-22 and a 5/8λ antenna on the trunk. The 16–76 Baltimore repeater is being moved around and at this time coverage seems to vary from day to day. I did work through it near Baltimore, but the coverage was not too good, even with the 10 watt amplifier. They will be moving it again soon.

Driving up the John F. Kennedy Tollway (I-95) we refreshed ourselves at a service station called the Maryland House, and lo and behold, there was a repeater on 25–85 within range. Not only was it within range, but it was loud and clear. That machine is located at Havre de Grace, Maryland, a few miles up the road. The locals are a very friendly lot and are always willing to talk to and assist passersby. Further up the road we came into range of the 13–73 device in Wilmington, Delaware. This repeater has extremely good coverage. I was able to work it well into New Jersey and from various Philadelphia suburbs on the return trip. The identification is something else. They have a sexy female-type voice identification well worth listening to.

Driving over the Delaware Memorial Bridge we were able to key up the 28–88 in Washington but nobody came back. I know that contacts are possible, because I've heard others break that repeater from out there. Soon we came into range of the 34–94 at Valley Forge. The 34–94 channel was busy all the way to New York; as soon as Valley Forge dropped out, Greenbrook NJ came in.

Driving past Cherry Hill on the New Jersey Turnpike I was able to work through the 16–76 Philadelphia repeater. It only seems to cover the southeastern part of the big city. Although it was good on the outward journey, I had problems getting into it from the northern suburbs on the way back. The next repeater to come into range was the 31–91 Tom's River machine with its female voice ID, at about Exit 8 on the Turnpike. I was able to put a good signal into it except when overtaking trucks. The S meter used to drop from full scale to zero as we passed the truck, and come back up again as the truck was left behind.

At about Exit 8A I was able to work through the 28–88 Staten Island repeater and was hearing all the New York City repeaters that I had crystals for except the 25–85 which did not become audible until Staten Island and workable until Brooklyn.

New York City is a great place to visit, but it costs a lot to get there. Back in the eighteenth century New York City was surrounded by highway men and footpads. In the twentieth century they legalized them and call them toll gate keepers.

G3ZCZ/W3

The Hamburglar

STRIKES AGAIN!

Larry Briggs W3MSN had a Drake ML-2, Ser. No. 10582 stolen with his VW Campmobile last June. The ML-2 has a broken on/off switch which should help identification. Larry can be reached at 5108 Boulder Dr., Oxon Hill MD 20021. 301-894-3977.

A Tektronics 453 oscilloscope was lifted on 6/3/73 from Bill Voight WB2FZU. Any information leading to its recovery will be greatly appreciated. Bill can be contacted at 18141 Frank, Apt. 103, Roseville MI 48066.

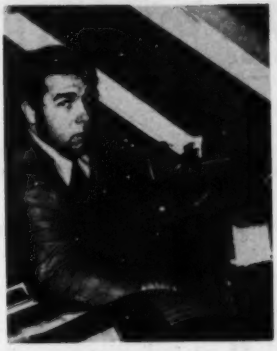
List from Past Issues:

Mfr., Model, Ser. No.	Owner	Issue
AF68 No. 10588 PMR8 No. 10918 M1070 pwr supply	K5LKL	1/73
Trio TR2200 No. 241988	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459	WA8WOA	4/73
NPC 107m pwr supply 2, 5AJ-IPL Onan Gen., No. 327895		
R4B No. 11578G	WA8GVK	6/73
T4XB No. 17801 G		
W4 wattmeter No. 8390		
Swan 250 No. F154806		
Swan ac pwr. sup. No. 0853556		
HR-2 No. 04-C2879	W6QSR	6/73
SB-34 No. 211828		
STD 826 No. 011298	WA2FSD	6/73
HT220 No. GJ7327	State Univ. of NY (Albany)	6/73
Yaesu FT-101 No. 82G12279/CW HR-2 No. 0302030	W4GF	7/73
Clegg 27B No. 72013-1088	W3BXL	7/73
Std 826MA No. 208078	WB2DEW	7/73

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

Many repeaters throughout the country are either owned by or associated with a given radio club. We all know this. But how many of these clubs have their own air force? To date I know of only one, the Pallisades Amateur Radio Club. Now, while most air force organizations throughout the world spend their time on matters of military importance to their respective governments, the PARC Air Force, as it has been unofficially dubbed, spends its time uniting private flying and ham radio. It was therefore more than a pleasure to accept an over-the-air invitation the other evening, and participate in one of their "reconnaissance runs" up the coast for dinner.

Normally on a Friday evening, anywhere from three to ten aircraft will partake of the festivities, but this evening it was to be a solo affair with Rod Dixon K6YTS as pilot in command. Since this was to be a photographic mission as well, we decided on a Cessna Cardinal as the best choice of flying machine, due to its high-wing



Rod Dixon K6YTS preflights our Cardinal.

strutless design. I must admit I was a bit apprehensive about taking a Cardinal, since some years ago Larry WA2PZI and I (and our instructor) found that the particular "bird" we had taken to East Hampton remained glued to the runway well after the airspeed indicator said that we should be airborne. That though, was an older model, and the new one with its 180 hp power plant and constant-speed propellor is far and away the kind of plane I would love to own some day. As I found out on the return trip, this 180 hp Cardinal handles amost as easily as a 150 trainer when properly trimmed.

We departed southwest out of Van Nuys and across the Santa Monica Mountains, located the shoreline of the Pacific and followed it north-northwest to Santa Barbara. Not to ignore the other part of this venture, Mortie WA6SNE brought along his Standard 146 and hammed along our route. It reminded me of happy days not so many years ago when Larry, Hank K2SSQ, Lou K2VMR, myself and others would join Jim WA2CPX and his Aero Commander 560 for our

Now you know what a WA2HVK/6 looks like.

73 REPEATER ATLAS REGISTRATION

REPEATER CALL* (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				EQUIPMENT
		Hz				
		Hz				
		Hz				☐ SPLIT SITE ANTENNAS & HEIGHT ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID--TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.

DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS

Sunday morning air-mobile adventures on 6 meter SSB and 2 meter AM. This was in pre-FM days, and I guess we were something of a novelty then. Now 3,000 miles away we were doing it again, only the Swan 250 and Gonset 1V had been replaced by a small hand-held unit with its own antenna. The people and aircraft were different, but the feeling was the same. After dinner we were airborne again, our destination Long Beach, to photograph the Queen Mary now permanently anchored there. She was a beautiful sight, all lit up like a Christmas tree. I took my pictures and then it was back again to the San Fernando valley for a "greased on" landing at the skillful hand of Rod. An evening with the "PARC Air Force" had come to an end, all too soon. This is but one of the activities that makes the Pallisades Amateur Radio Club one of the most successful amateur organizations today. They work hard at having a good time.

Since there is a lot to cover, and little space left, the following are Southern California Quickies I will elaborate on in coming months. It has been unofficially reported that Northern California has adopted a 220 band calling for 1.6 MHz split and 40 kHz separation. By the time this gets into print the SCRA will have met and released its decision for this area. The on-the-air opinion is that we will go the same route, *but* with option to split separation to 20 kHz in the future.

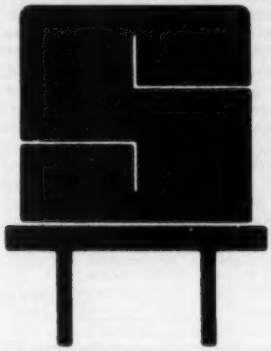
I had a peek at the new "fully synthesized" ICOM IC 200 two meter rig at the Lockheed ARC hamfest. It's quite a little radio. That's Max K6GLG of ICOM FM Sales demonstrating it in the picture.

The auto-MCW being heard on 223.0 is both a beacon and "smoke

(Continued overleaf)

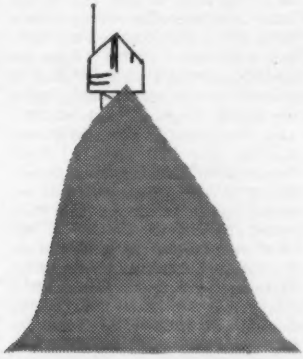
FCC WORKS OVERTIME!

CA	WR6ABB	Los Angeles	01–61
	ex WB6ZDI		
CA	WR6ABD	San Jose	04–04
CA	WR6AAC/B	Los Angeles	37–97
	ex WA6ZZE		
CA	WB6AAE	Oakland	22–82
CA	WB6NDJ	Oakland	28–88
CT	WR1ABE	Bridgeport	146.295–146.895
	ex WA1JTB		
GA	WR4ABC	Atlanta	37–97
	ex WB4UZV		
ID	WR7ABA	Boise	28–88
	ex W7CTX		
IL	WR9ABH	Western Springs	223.38–224.98
	ex WB8AET		
IL	WR9ABB	Hinsdale PL 107.2	07–67
	ex WB9NNL		
IA	WR6ABD	Dubuque	34–94
MD	WR3ABB	Greenbelt	28–88
	ex WA3EFG		
MD	WR3ABC	Cheverly	01–61
	ex WA3KWG		
MA	WR1ABB	Framingham	146.55–147.15
	ex K1AIU		
MA	WR1ABI	Fall River	52.810–52.700
MA	WR1ABJ	Weston	22–82
	ex WA1KHB		
MA	WR1ABG	Webster	28–88
	ex K1CRR		
NH	WR1AAB	Peterborough	146.19–146.79
	/Tandem operation on 2m\		222.34–223.94
			444.10–448.10
VT	WR1AAB	Mt. Equinox	146.19–146.79
NJ	WR2ABN	Oakland	16–70
	ex WB2LPV		
NY	WR2ABE	Port Chester	34–94
OR	WR7ABE	Portland	444.17–449.17
	ex K7SJQ		
PA	WA3KXG	Ettors	16–76
PA	WR3ABD	Richboro	16–76
	ex WA3CAG		
TX	WR5ABB	Seguin	34–94
	ex WA5UFL		
TX	WR5ABC	Victoria	16–76
	ex W5FDE		
TX	WR5AAA	Houston	28–88
	ex WA5YUX		
WA	WR7ABC	Renton	22–82
	ex W7RC		
WV	WR8ABB	Fairmont	28–88
	ex K8MYU		
CANADA			
BC	VE7VAN	Vancouver	147.72–147.12
ONT	VE3TTY	Toronto	16–70
	(Teletype only)		



REPEATER OWNERS

Don't Take Chances. SENTRY offers custom made crystals made exactly to your specifications. When it comes to crystals for your repeater, BUY THE BEST – SENTRY.



REPEATER USERS

If you want reliable access to the repeaters in your area, you want and need SENTRY CRYSTALS. SENTRY CRYSTALS are custom made for your rig. We don't stock a large quantity of crystals for a certain frequency and hope you can tweak them to frequency in your rig. We do offer FAST service on crystals made especially for you and your rig. If you want reliable, on-frequency operation, INSIST ON SENTRY.

SENTRY MANUFACTURING COMPANY
Crystal Park, Chickasha, Oklahoma 73018

PHONE: (405) 224-6780
TWX-910-830-6425

Max K6GLG demonstrates new ICOM IC200 rig.

test" for the ICOM FM Repeater Club transmitter. By the way, it looks as if L.A. will finally have a 34–94 repeater, 223.34–224.94. That's the pair that the aforementioned group will be operating.

The WA6LNU 220 MHz AM repeater is temporarily off the air. I met Lynn at lunch the other day, and he told me he took it off for both time factors and to update it. It will be back on in the future – possibly FM.

Communications for the Baja auto race will be handled by amateur radio this year, both lowbands and a bit of two meter FM. A group from this area is heading south of the border to work on this project. Will report results soon.The San Fernando Valley ARC is planning an open 450 MHz repeater if they can gain the necessary support. It will be the only one of its type in the L.A. area to my knowledge. Hope they go through with their plan.

I have received letters from a number of readers commenting on the "break in" standardization system discussed in my June column. Seems 50% for and 50% negative. Will discuss further next month.

I have heard from Doc W2BIV, Gene K2AKV and Lou K2VMR of my old Brooklyn group and have a lot more info on the situation concerning WA2ZWP and why it finally failed. I have to agree with Gene in part when he says that a schism developed between the technical people and the administrative people within the organization. In a letter too lengthy to reproduce here, he went to the task of giving me a point-by-point description of all the events that took place since my move to L.A. forced me to vacate my position with the organization. The more I learn, the more I am convinced that no one person can be held responsible for the situation. Though Gene, as site committee, acted as the final decision-making agent in the repeater leaving the air, he was put in a position that offered him little choice. Rather than continue here, I am preparing a separate article that will detail what happened to us in the hope others can learn from our mistakes. In the meantime I wish Lou and the new leadership the best success in reviving the Brooklyn machine. One piece of advice, keep the administration people separate from the technical people. Let those capable of leadership assume that role, and those who are technically oriented maintain and improve the machine.

WA2HVK/6

NATIONAL SCOUT JAMBOREE

Special amateur radio stations will be in operation at each of the two Scout Jamboree sites: Farragut State Park, Idaho, and Moraine State Park, Pennsylvania. Three separate operating positions are expected to be manned almost continuously, using the special events call signs KJ7BSA July 28–August 9 from Idaho, and KJ3BSA July 30–August 11 from Pennsylvania. QSL requests accompanied by a stamped, addressed envelope may be directed to 225 Main Street, Newington CT 06111. All other contacts will be confirmed via the bureau. Suggested frequencies for finding KJ3BSA and KJ7BSA are 5 kHz above the lower limit of the General and Novice subbands: for example, 3530, 3705, and 3895 kHz on 80 meters.

1973 INTERNATIONAL FIELD DAY

The Burlington Amateur Radio Club, Incorporated, Burlington, Vermont, will sponsor the 1973 International Field Day at the Old Lantern, Charlotte, Vermont, on Sunday, August 19, 1973. Registration is $3.50 at the gate, $3.00 for Early Birds – write to Bob Sanford W1FIS, South Hero, Vermont 05486.

CENTRAL IL - DOINGS

East Central Illinois' finest hamfest. Sunday, September 2 at Douglas Park in Danville, Illinois. Take the Bowman Avenue exit off Interstate 74 and follow the signs. Flea market will open at 6 a.m. Drawing at 3 p.m. Talk-in on 34/94. Camping facilities nearby. Write WA9IAC, 1615 N. Bowman, Danville, Ill. 61832.

NH ANNIVERSARY

To celebrate the 350th anniversary of the first settlement in the State of New Hampshire the special events station WP1ORT will operate during the period 1–19 August 1973. Modes of operation will be CW, SSB and SSTV. Probable phone frequencies are 14.230 (SSTV), 14.300, 7.250 and 3.925 MHz. QSL with S.A.S.E. or S.A.E. and IRC to P.O. Box 1973, Portsmouth, New Hampshire 03801.

KNRC HAMFEST

The Kansas, Nebraska Radio Club, Concordia, Kansas, presents their 22nd annual KNRC hamfest on Sunday, August 5, 1973, at the Moose Building, 113 W. 5th St. There will be a mobile talk-in on 3920 kHz and on 146.94 or 94–34 repeater. Bring your favorite covered dish, free soft drinks, swap tables. Registration begins at 9:00 a.m.

ZERO-BEATERS ARC

Washington, Missouri – Zero-Beaters ARC annual hamfest, August 5, over $700.00 prizes. Ham auction, large Traders Row, entertainment for XYL and children. St. Louis ARC Ham of the Year award. Missouri Army MARS Meeting. Write Zero-Beaters ARC, Box 24, Dutzow, Missouri 63342 for tickets and information.

INDIANA RC PICNIC

August 19 at the Tippecanoe County Fairgrounds, located at 1100 Teal Road (indiana Route 25), Lafayette, Indiana. This is a family hamfest. Flea market, games, trailer parking, awards, and more! Tickets from any IRCC club, by mail, or at the gate. Tickets by mail from WB9FOT, 2233 Delaware Drive, West Lafayette, Indiana 47906. All tickets $2, but if purchased by August 1 owner is eligible for pre-registration prize of a Motorola HT 220.

KNIGHT RAIDERS

The Knight Raiders VHF Club, Inc., K2DEL, will be holding its seventh annual hamfest on Saturday, August 11, 1973, starting at 10 a.m. at the YM/YWHA Camp, Rifle Camp Road, West Paterson, New Jersey. Gigantic flea market and auction, swimming and boating. Pinic tables and BBQ pits available. Contests, door prizes, displays. Refreshments will be available. Navy MARS meeting. Talk-in 94 FM, 145.71 AM and 50.200 SSB. Tickets $1.00 in advance, $1.50 at the door. Children under 12 free.

For more information and tickets contact: Knight Raiders VHF Club, Inc. P.O. Box 1054, Passaic, New Jersey 07055.

SHENANDOAH VALLEY

The 23rd annual hamfest of the Shenandoah Valley ARC will be held in Winchester, Virginia, August 4th and 5th. Our program will consist of a banquet on Saturday evening and an all-day session on Sunday in the Winchester Armory. Contact L. Neill Woods, W4LOG, Box 139, Winchester VA 22601.

75M PICNIC

Marshalltown, Iowa – The annual Iowa 75 Meter Net potluck picnic will be at Riverview Park on August 26, 1973. Swap Tables – Prizes. Serving at noon. Coffee and pop furnished. Everyone is welcome.

MN Hm-Fst

The St. Cloud ARC is having their hamfest on Sunday, August 12. Place – Sauk Rapids Municipal Park, Sauk Rapids, Minnesota. $1 registration, rain or shine. Refreshments, games, transmitter hunt, gear swap, etc. For further info contact Gary WNØGSE and/or Lolly WNØGSD Loomis, Box 103, Clear Lake, Minn. 55319.

SIERRA HAMFEST

The Sierra Hamfest will be held on Saturday, August 18, 1973, at the California Bldg. in Idlewild Park, Reno, Nevada. For further information contact George V. Lyle K7ZAU, 1047 Mark Way, Carson City, Nevada 89701.

TACOMA HAMFAIR 73

The Radio Club of Tacoma presents "Hamfair - 73" Saturday and Sunday, August 18th and 19th, at the Pierce County Fairgrounds near Graham (directly south of Puyallup on Meridian Avenue) – manufacturer's displays – technical seminars – games – contests – prizes – bunny hunts – swap shop – snack bar – Registration including Saturday evening dinner – $6.00. (Advance registration only) Registration at door or without dinner – $3.00. Tent, trailer, or camper space $1.50 per night. Sunday Logger's Breakfast $1.50. 3965 kHz and 146.76 MHz monitored for mobiles. Contact registration chairman – Emil Koth, K7GPF, 13616 10th Avenue East, Tacoma, Washington 98445.

SIX METER CLUB HAMFEST

The Six Meter Club of Chicago Inc. will hold its 16th annual picnic and hamfest on Sunday, August 5th at the Frankfort Picnic Grove, 1 mile north of U.S. 30 on U.S. 45 Frankfort, IL. Food and drinks will be available, Swap and Shop section provided. Advance registration $1.50. Admission at gate $2.00. For tickets and further information contact Val Hellwig K9ZWV, 3420 South 60th Court, Cicero, IL. 60650.

KENTUCKY HAMFEST

The third annual Greater Louisville hamfest will be held August 26, 8:00 a.m. to 6:00 p.m. at the Oldham County Fairgrounds, LaGrange, Kentucky, on S.R. 146 off I-71. Admission and registration $1, flea market $1. Five major prizes, door prizes, ladies' program, food and refreshments, plenty of parking. Contact: Guy E. Partridge, K4KZH, 8276 Walker Road, Louisville, 40258.

R.S.O. ANNUAL CONVENTION

The annual convention of the Radio Society of Ontario Inc. will be held on 17, 18, 19 August 1973 at Queens University, Kingston, Ontario. This is the major amateur event in Ontario. R.S.O., C.A.R.F., and A.R.R.L. Forums, technical forums, banquet, demonstrations, displays, prizes, social events, etc. Accommodation is available at Victoria Hall (on campus) and a trailer park is located at nearby Lake Ontario Park. Check the 'CJ' net nightly (3790 kHz, 2230 GMT) for details or write Kingston A.R.C., P.O. Box 1402, Kingston, Ontario for full information.

TEXAS SWAPFEST

The eighth annual Northest Texas Emergency Net Picnic and Swapfest will be held at the City Park in Levelland, Texas on Sunday, Aug. 5, 1973. Bring your own picnic basket. Free registration begins at 0900. Lunch at 1300. Swapping all day. Mobile talk-in frequency is the net freq. 3950 kHz 28–88, 34–94.

NORTH AL HAMFEST

The North Alabama hamfest will be held in Decatur, Alabama August 19, 1973. For information write North Alabama Hamfest Assn. Inc., Box 9, Decatur, Alabama 35601.

HUB CITY SD

The Hub City Radio Club of Aberdeen, South Dakota, is sponsoring the annual South Dakota ham picnic August 4, 1973 at Wylie Park, Aberdeen, from 10:00 a.m. to ??? Prizes, flea market, activities for XYL and Jr. Ops. Limited camping available. For information or tickets contact: WØOGS, 1017 7th Ave. S.W., Aberdeen, S.D. 57401. Talk-in on 3955 kHz and 146.94 MHz.

FCC NEWS

220 MHz NEWS!! – See p. 36.

STUDY QUESTIONS

Following is a list of study questions provided by the FCC for Novice element 2 examination:

NOVICE

Rules and Regulations

1 What is the Amateur Radio Service?
2 What Part of the Federal Communications Commission's Rules govern the Amateur Radio Service? What are the maximum penalties for violating those rules?
3 The Rules encourage and improve the Amateur Radio Service by providing for advancing skills in what two phases of the radio art?
4 What is the definition of an amateur radio operator? Of an amateur radio station?
5 For how long is a Novice Class license valid? May it be renewed?
6 May a transmitting station be operated in the Amateur Radio Service without being licensed by the Federal Communications Commission?
7 Who may hold an amateur radio station license?
8 Where must an amateur radio operator license be retained? An amateur radio station license?
9 Who is responsible for the proper operation of an amateur radio station?
10 What is the definition of a control operator? Who may be the control operator of an amateur radio station?
11 What is the log of an amateur radio station? What information must it contain? How long should it be preserved?
12 What are the frequency privileges authorized to Novice Class licensees?
13 What are the emission privileges authorized to Novice Class licenses?
14 What is the maximum transmitter power privilege authorized to Novice Class licensees?
15 What are the Rules regarding the measurement of the frequency of emissions from an amateur radio station?

Radio Phanomena

1 How fast do radio waves travel in free space (in meters per second)?
2 What is the relationship between the frequency and the wavelength of a

(Continued on p. 16)

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Suite 3
Phoenix, AZ 85029

CALIFORNIA

CDS Electronics & Hobbies Unltd.
235 Mitchell Drive
Atwater, CA 95301

Electro Service
240 Main Street
San Mateo, CA 94401

ICOM FM Sales
6234 A. Fountain Blvd.
Hollywood, CA 92028

Henry Radio Company
11240 W. Olympic Blvd.
Los Angeles, CA 90064

Selectronics
1709 Markston Road
Sacramento, CA 95825

Sequoia Stereo
773 - 8th Street
Arcadia, CA 95521

Sichel Equipment Co.
245 E. Harris Avenue
S. San Francisco, CA 94080

FLORIDA

Goldsteins
Box 3561
Pensacola, FL 32506

ILLINOIS

Erickson Communications
4653 N. Ravenswood
Chicago, IL 60640

MARYLAND

COM Electronics
900 Crain Hwy. S.W.
Glenn Burnie, MD 21061

NEW MEXICO

Robert Foster
Box 198 – Escabosa Star Rt.
Tijeras, NM 87059

NEW YORK

R. E. Nebel Laboratories
31 Whitehall Blvd.
Garden City, NY 11530

NEW YORK (cont.)

Barry Electronics
512 Broadway
New York, NY 10012

OHIO

H & C Electronics
6271 Hammell Avenue
Cincinnati, OH 45237

OKLAHOMA

Blacks Radio Company
413 N.E. 38th Terrace
Oklahoma City, OK 73106

Roland Radio Company
5923 E. 31st Street
Tulsa, OK 74114

OREGON

Portland Radio Supply
1234 S.W. Stark
Portland, Oregon

SOUTH CAROLINA

Electronic Systems Inc.
1518 Gregg Street
Columbia, SC 29201

TEXAS

Bellaire Electronic Supply
5204 Bellaire Blvd.
Bellaire, TX 77401

Electronic Center Inc.
2929 N. Haskell
Dallas, TX 75204

K. A. Sales Inc.
1312 Slocum
Dallas, TX 75207

Trimble Electronics
2810 Alexandria
Tyler, TX 75701

UTAH

Utah FM Sales
1365 E. 5360 So.
Salt Lake City, UT 84117

WASHINGTON

ABC Communications
17541 – 15th N.E.
Seattle, WA 98155

ABC Communications
2002 Madison Avenue
Everett, WA 98200

N.H.E. Communications
15112 S.E. 44th
Bellevue, WA 98006

Progress Electronics
852 Commerce Street
Longview, WA 98632

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Alamogordo, New Mexico 88310

Midwestern States

Gloria M. Ligon, K8WKE
47160 Condor Street
Utica, Michigan 48087

DX REPRESENTATIVES

BCN Agencies Pty. Ltd.
178 Collins Street
Melbourne 3000, Victoria
Australia

The Wireless Institute of Australia
478 Victoria Parade
P.O. Box 36
East Melbourne, Victoria
Australia

Carlos Rohden
Caixa Posal 5004
Sao Paulo, S.P.
Brasil

Jim Coote
56, Dinsdale Avenue
Kings Estate
Wallsend
Northumberland, England

Radio Society of Great Britain
35 Doughty Street
London WC1N 2AE, England

Short Wave Magazine
55 Victoria Street
London, SW1, England

Bryan Fogerty
Irish Radio Transmitters Society
9 Wellington Street,
Dun Laioghaire, Eire

Wireless Services, P.U.Sukhadia,
1/16, Shantinath Bhuvan,
427, Sion Road
Matunga, C. Rly.,
Bombay 19, India

Orion Books
13-19 Akasaka 2-chome
Minato-ku
Tokyo 107, Japan

Tams Electronics Co., Ltd.
Towa Building 502
515 Higashi Oizumi, Nerima-Ku,
Tokyo 177, Japan

Sun Electron Corporation
15–20 Takaban-1-chome
Meguro-ku, Tokyo 152, Japan

Kushal Harvant Singh
83, Aulong Road off Stephens Road
Kampong Boyan
Taiping, Perak, Malaysia

Gordon and Gotch Ltd.
P.O. Box 584
Auckland, New Zealand

G. H. Gillman
Smarts Road
Waikuku RMD
Rangiora, North Canterbury
New Zealand

New Zealand Assn. of Radio Transmitters
P.O. Box 1459
104 Hereford Street
Christchurch, New Zealand

Harold C. Leon
P.O. Box 61141
Marshalltown, Transvaal
South Africa

South African Radio Publications
P.O. Box 2232
Johannesburg, South Africa

South African Radio Relay League
P.O. Box 3911
Cape Town, South Africa

Julio Antonio Prieto Alonso, EA4CJ
Donoso Cortes No. 58
Piso 5O, Letra B
Madrid 15, Espana (Spain)

All Europe,
except Great Britain & Ireland:

Eskil Persson, SM5CJP
Frotunagrand 1
194 00 Upplands Vasby
Sweden

HAM HELP

If you need help getting your license, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can.

Prof. M. Gerhman
7 Harris Road
Orono ME 04473

Jesse Cole
P.O. Box 767
Cheyenne WY 82001

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(Continued from p.13)

radio wave? What are the approixmate wavelengths for the frequency bands available to Novice Class licensees?

3 How are radio signals transmitted across great distances? Which of the amateur radio frequency bands available to Novice Class licensees are most likely to result in long distance communication during the daylight hours? At night?

Operating Procedures

1 When transmitted by telegraphy, what is the meaning of each of the following: CQ, DE, K, AR, SK?

2 What is the RST reporting system? What is the meaning of "RST 579?"

3 What are "Q signals?" What is the meaning of QRM? The meaning of QRS? The meaning of QRU? The meaning of QRZ? The meaning of QTH? The meaning of QSL?

4 In what manner should a transmitting frequency be selected for an amateur radio station? What additional factors should be considered when selecting a transmitting frequency near one end of the authorized frequency band?

Emission Characteristics

1 What is an A1 emission?

2 What are the characteristics of a good quality A1 emission?

Electrical Principles

1 What is electromotive force? Current? Electrical power? What are their units of measurements?

2 What is direct current? Alternating current? How can alternating current be converted into direct current?

3 What is a cycle? A kilocycle? A megacycle? A hertz? A kilohertz? A megahertz?

4 What is "r.f.?"

5 What is the relationship between a fundamental frequency and its second harmonic? Third harmonic?

6 What is: Resistance? Inductance? Capacitance? What are the units of value for each?

Practical Circuits

1 Draw the schematic diagram of a circuit having the following components:
(a) battery with internal resistance
(b) resistive load
(c) voltmeter
(d) ammeter

2 From the values indicated by the meters in the circuit above, how can the value of the resistive load be determined? How can the power consumed by the load be determined?

3 In the circuit, what must the value of the resistive load be in order for the maximum power to be delivered from the battery?

4 Draw the schematic diagram of an r.f. power amplifier circuit having the following components:
(a) triode vacuum tube
(b) pi-network output tank
(c) high voltage source
(d) plate current meter
(e) plate voltage meter
(f) rf chokes
(g) bypass capacitors
(h) coupling capacitor

5 What is the proper tune-up procedure for the circuit?

Circuit Components

1 What is an insulator? A conductor? A semiconductor? Gite an example of each.

2 Draw the schematic symbol of a resistor, a capacitor, an inductor, a transformer, a choke.

3 Draw the schematic symbol of a diode. A transistor. A triode vacuum tube.

Antennas and Transmission Lines

1 What is a dipole antenna?

2 What is a half-wave antenna? What are the approximate lengths (in feet) for half-wave antennas for the frequency bands authorized for Novice Class licensees?

3 What is a transmission line? What are some commonly-used transmission lines?

4 What are some advantages of a multiband antenna? The disadvantages?

Radio Communication Practices

1 What precautions can be taken to reduce the possibility of shock hazard in amateur radio stations?

2 Draw a schematic block diagram of an amateur radio station having the following components:
(a) receiver
(b) speaker
(c) transmitter
(d) telegraphy key
(e) transmission line
(f) antenna
(g) ground rod
(h) transmit/receive antenna switch

3 What is the purpose of each component in the schematic block diagram?

4 What is the power input to a vacuum tube in the final amplifier stage of a transmitter, exclusive of power for heating the cathode, for the following operating conditions:

Driving power	0.5 watts
Plate voltage	600 volts
Plate current	140 milliamperes
Screen voltage	175 volts
Screen current	10 milliamperes
Filament voltage	6.3 volts
Filament current	0.8 amperes

5 What methods are most often used by amateur radio licensees for determining that an emission line from a transmitter is within an authorized frequency band?

6 What methods are most often used by amateur radio licensees to determine the quality of emissions from their stations?

7 What is a transmatch? What are the advantages of using a transmatch?

FIJI — — JORDAN

ARRL Headquarters announces that a reciprocal operating agreement has been signed between Fiji and the U.S., this actually being an extension of the privileges existing under the agreement signed with Britain.

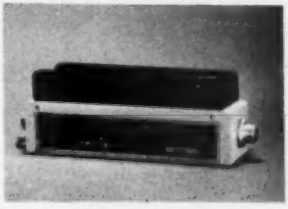
Also signed has been an agreement for the handling of third-party traffic between the U.S. and Jordan.

QSL CONTEST

Joseph Mikuckis K3CHP, 6913 Furman Parkway, Riverdale MD 20840, wins this month's QSL Contest and a one year subscription to 73. Send your entry to *QSL Contest, 73 Magazine, Peterborough NH 03458.*

NEW PRODUCTS

15 WATT AMPLIFIER



A compact 15W 2 meter amplifier has just been added to VHF Engineering's line of FM equipment. The PA-1501 H is available in either kit form for those who like to build, or wired and tested for those who are looking for a fast way to increase the power of their 1-2W mobile rig. The amplifier features solid state switching (less than 1 dB loss on receive) and operates from your automobile's 12V power supply.

Although it can be used with any low power FM rig, a nice little 15W transmitter can be had by matching the amplifier with VHF's TX-144, a 1W transmitter kit they sell for $29.95. Since the amplifier kit sells for $39.95, the total cost of a complete 15W rig is $89.90 — not bad! The cost of the wired and tested amplifier is $49.95.

The amp is a perfect match for transceivers of the TR-22 class. It can be permanently mounted in the car to boost your signal strength, while letting you retain the transceiver's portability as the only connection to the rig is via antenna cable.

For information on the PA-1501 H and other FM products, write *VHF Engineering, 320 Water St., POB 1921, Binghamton NY 13902.*

10 AMP SUPPLY

E&L Instruments, Inc., has developed a new power supply, designed primarily for home operation of mobile equipment. The unit, called the PW-4, produces enough power to operate both an FM transceiver and an amplifier simultaneously. The PW-4 uses 110–120V ac input power, and produces a rated output of 13V dc at *10 amps*, I.C. regulated to ±3%. This increased power capability means that high power mobile units can be taken into homes for use atnight. The supply features a modern cabinet design, current limiting, and reliable heavy duty components.

It can be used with most 12–13V dc transceivers, together with 50–60W amplifiers. The PW-4 is available direct from the factory, or local distributors. For further information contact *E&L Instruments, 61 First Street, Derby CT 06418.*

NEW FCC APPROVED REPEATER ANTENNAS

Antenna Specialists Co. has received approval on the following list of antennas from the FCC for use on amateur repeaters under the FCC Docket 18803.

Model ASP-298 – 2M, omnidirectional, 4.5 dBd.

Model ASPB602 – 2M, omnidirectional, 6.0 dBd.

Model ASPB602 – 2M, directional, 9.0 dBd.

Model ASPA680/681 – 2M, omnidirectional, 3.55 dBd.

Model ASP-701 series – 3/4M, omnidirectional, 8.25 dBd.

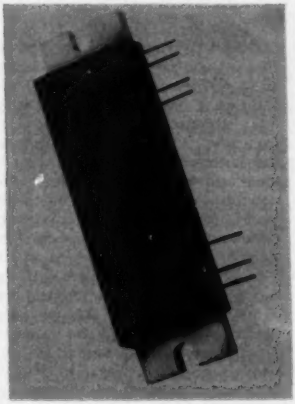
Model HM-191 – 3/4M, omnidirectional, 8.25 dBd.

Model HMR173 – 2M, directional, 13.0 dBd.

Model HM-173 – 2M, directional, 13.0 dBd.

For further information write to *The Antenna Specialists Co., 12435 Euclid Ave., Cleveland OH 44106.*

UHF POWER MODULES

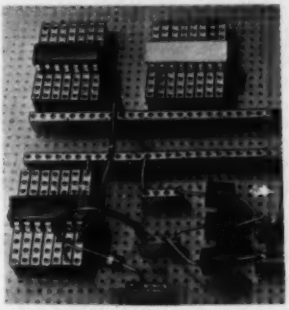


Three integrated UHF hybrid power amplifiers, which deliver 10, 13, and 15 watts respectively at 450 MHz, have been announced by the RCA Solid State Division. The RCA-R47M10, R47M13 and R47M15 are complete solid-state hybrid integrated power amplifiers for use in mobile communications equipment. Each amplifier consists of three cascaded stages interconnected by matching networks that use microstrip lines and thick-film capacitors on alumina substrates. They operate across the frequency range from 440 MHz to 470 MHz, with 20 dB gain, using a power supply of 12.5 volts. They have high efficiency (typically 40%), 50-ohm input and output impedances, and infinite load-VSWR capability. The package is compact, permitting high packing density.

These modules are certainly going to revolutionize the process of assembling UHF power amplifier stages. They completely eliminate the discrete components associated with solid state design and their usual matching problems.

The prices (at the 100 unit level) run from $31.20 to $42.00. For further information contact *RCA Solid State Division, Box 3200, Somerville NJ 08876.*

HI–SPEED BREADBOARD



A new breadboard terminal system provides speedy solderless assembly and connection of discrete semiconductors, ICs, pots, switches and other passive devices.

The terminal system, designated Klip-Strip by Vector Electronic Co., consists of connected spring clips assembled in groups of four, called "quads", and in groups of 32 and 48, called "bus strips". All components are accessible and circuits are easily modified. Bus strips of eight and twelve connected queda supply common signals and power. Components inserted in the quads from either top or bottom are held firmly without solder and interconnected with ordinary jumper wire sizes 20-24 AWG. Larger wire can be plugged into open ends of quads.

Klip-Strips and individual quads are available from stock and priced at $0.09 per quad in packages of 100. Kits containing quads, strips, insertion and extraction tools, and assorted hardware are available at nominal cost.

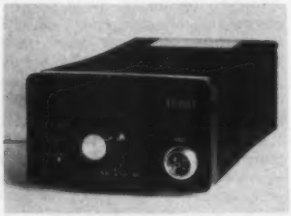
For more information contact *Vector Electronic Company, 12460 Gladstone Avenue, Sylmar, California 91342. (213) 365-9661.*

ENCODER ENCLOSURES

Finally available are attractive Touch Tone encoder enclosures for base or mobile station use. Your pad is held properly in position by premounted inside brackets. Top and sides are walnut-wood-grain vinyl covered. The satin anodized aluminum face is die punched to accept the standard twelve button dial. (Western Electric, Stromberg-Carlson, ITT-

Kellogg, etc. – but automatic electric dials will not fit because they use non-standard spacing between the buttons.) The mobile mount "M" enclosure has an anodized pivoting gimbal bracket which provides multi-position under instrument panel mounting, as well as top of equipment mounting on four rubber feet. The base station model "B" holds your dial at a convenient 30-degree angle. There is ample room inside both models for transmitter keying circuitry. Either model is $5.50 (donation) plus postage and handling – dial not included. Available from the *Detroit Area Repeater Team, P.O. Box 201, Clawson MI 48017.* Donations are used to maintain and upgrade repeater station equipment and facilities.

450 MHz TRANSVERTER



SBE has just announced the SB-450 TRC, a 450 MHz transverter that lets you gain access to 450 with your 2 meter FM rig. Feeding it with 10 watts of 2m power will get you 4W output on 450 via its varactor tripler. Although it is specifically designed for use with the SBE-144, any 2m rig will work fine as long as the 2m drive never exceeds 12 watts.

Since the transmitting process is straight tripling, your 2m rig will need to have a few extra 450-only crystals installed. This should not be a problem if your rig is a multi-channel unit or if you use a synthesizer. For example, if you wish to transmit on 449.500, a crystal giving you a two meter output of 149.833 will have to be installed. Since this is no longer in the 2 meter band, you might expect a slight drop in output power due to the transmitter's circuitry being peaked to 146-148. Most rigs have sufficiently broad output circuits however, and a small drop in output is not something to worry about in a system that is basically passive to begin with. The transmitting section of the 450 TRC draws no dc power while transmitting.

The receiver section converts via a 300 MHz local oscillator signal to its mixer. This puts the signal in a reasonable portion of the band. If you wish to receive a signal of 444.500, a 2m receive crystal that tunes your rig to 144.500 must be installed. Since you are adding only a front end converter to your 2m rig, it retains all of its characteristics such as selectivity, audio quality, etc. The 450 conversion gain is close to 1.0:1 so as not to inject unnecessary gain into a system that may already be adequate.

If you have been thinking of going 450 but haven't wanted to spend a bundle on a whole new transceiver, the SBE 450 TRC may be worth consideration. For more information contact *Linear Systems, Inc., 220 Airport Blvd., Watsonville CA 95076.*

(W2NSD/1 continued from p.2)

Other than the promise of el cheapo radios, the docket would seem to offer little.

So what does the docket take away from amateur radio? Well, not a lot from the average amateur. Perhaps this is unfortunate, in a way, for if there were some impending doom, the response to the FCC might be a little more heated. The Walker repeater rules have so emasculated the development of FM that the promise of the 220–225 MHz band has been virtually laid to rest anyway. The prospect is a dismal one – if we put up a great big fight to retain our band and keep the CBers at bay, we still have to get into a long hassle with Walker to try and roll back, inch at a time, the devestating recent repeater rules before we can begin to get benefit from the band.

This is what happens when you are a sitting duck with no Washington lobby.

You're as helpless as a young girl trying to cross Central Park at midnight – and you're going to get the business.

The 220–225 MHz band has a lot to offer us if we can get the rules straightened out. Our work here at 73 with the new Clegg 222 MHz repeater has shown us that the band is terrific. We get about the same range as 146 MHz, but the repeaters are much, much simpler since the separation has been established at 1600 kHz instead of only 600 kHz, as on 146. Diplexers are still not vest pocket sized, but they are plenty small enough to pop into a plane or a car for a quickie mobile repeater – and they are a lot less expensive.

If 146 MHz has not been castrated by the new repeater regulations and activity does indeed increase, it won't be long before the 220 band will grow substantially in importance to provide relief for the more congested 2m areas.

One other possible benefit that has been suggested by amateurs to getting the CBers into the top end of the 220 band is that there will be an inevitable leak from the CB end into the ham part of the band. It won't take CBers long to figure out how to make up convincing ham calls and join in our repeater fun with their rigs. It is possible that they may tend to accept ham standards of contact rather than CB, in which case we would have a very difficult time telling real hams from ersatz. It has been further suggested that as long as they act like hams, perhaps few amateurs will really care. It's something to think about.

After you've read through the docket – talked it over on the air and at your club, sit down and write the Commission and file your thoughts with them – with 14 copies – plus one for me (please).

KEEP PLUGGING

Those amateurs who are familiar with the benefits of repeater operation realize that this is the greatest thing yet devised for dealing with emergency situations.

The ideal repeater-emergency setup would permit a repeater to be operated as a local repeater during normal times and then in time of emergency it would be capable of providing 24-hour a day communications over a small area – over a wide area – or even over hundreds or thousands of miles, if needed.

The true emergency system would permit repeaters over a group of areas to be interconnected on command. Most of all, the system would be flexible.

Knowing the above, can we really settle for any less? The above certainly is well within our technical competence, even though not very much like that has been set up as yet.

It is a fact that most of the above is absolutely against the law. It is illegal to run a repeater 24 hours a day unless there is an operator right there in control – and obviously no operator would be needed for an emergency. It is illegal to interconnect more than two repeaters even though this limitation would be considered ridiculous for an emergency system. It is illegal to run crossband – and that too would be of immense importance for an emergency system. And so it goes.

Perhaps amateurs should build up these systems for use in emergency, but (since it is illegal) not test them and depend upon waiting for the disaster to work out the inevitable bugs. Walker has admitted that in times of serious emergency that all rules are off – so at that time we could get going on making our system work.

One interim measure that would be both fun and of value would be to set

up an interconnected system of repeaters, but with the limitation that only one repeater could be interconnected to another at a time. In this way we might be able to touch-tone up any of several repeater combinations. The paperwork involved in licensing a system like this would be almost beyond belief! I suspect it would take ten good men ten days to fill out all the Walkerforms required.

THOSE UFOs

A couple of readers have written recently to suggest that some sort of UFO net be set up to help get reports of UFOs to the UFO organizations. Those readers with a long memory will remember when I might have jumped to champion such a scheme. We did support a UFO net for a couple of years – but it didn't come to much.

Now, after a good deal of thinking and puzzling over the phenomenon, I think I have a pretty good idea of what the UFOs are all about – where they come from – why they are here – what they are doing – and why we haven't been able to get hard facts about them.

I think the light began to really dawn for me when I read an article a couple of years ago in the British magazine *Flying Saucer Review*. They had a very good article showing photographs of cave paintings that had the most commonly observed type of UFO depicted, complete with "space men." These paintings had been made between 20,000 and 30,000 years ago and covered a period of about that sweep.

Perhaps I should admit that about the time that I read my 500th detailed story about a sighting of these contraptions I gave up any idea that they did not really exist. This was helped by talks with good friends of years who had seen them up fairly close. Okay, so there is something – why are the UFOs so hard to pin down? Gradually it dawned on me that this was a factor that should fit into the whole picture – for some reason the UFOs have remained ephemeral and are continuing to remain such. And every time someone gets anything approaching hard evidence something odd happens to it. Hmmm.

Now what kind of a civilization could be inventive enough to think up and build a UFO – and then not change the model for over 30,000 years? That's patently absurd, of course. And how do we explain so many different types being spotted in the last few years? It all must fit together some way.

The obvious answer is that some time in the future – perhaps around 5688 A.D., they invented a way to travel through time and applied this to their then current saucer model Chevrolet. Quite a few historians came zipping back through the years to get data and bring the history books up to date – hence saucers being reported from so far back – in the diaries of Alexander – and off and on since then.

This might explain why the people who come back in them resemble us so much – yet are a bit different – some being a bit smaller – some a bit larger. Most of them seem to have helmets – perhaps around the year 2000 the carbon monoxide from car exhaust got so pervasive that people adapted to it and when they come back they can't manage on our "pure" air. Whatever.

We don't have any experience with the laws of time travel so we don't know just what will happen when a man goes back and kills his grandfather – but it would seem to be a bad scene and I expect that these rules will be worked out by trial and error by those first travelers in their saucers. If they louse things up enough to change the future it might be that they would have to come back again and fix their boo-boo. It is fun to speculate about it.

For this reason I am reasonably sure that the UFOs are going to remain elusive and it follows that any attempts at trying to catch them via amateur radio will be exercises in futility. They don't dare be really caught – and if anyone does, the UFOs will have to go back again and uncatch themselves.

I hope I haven't been a party-pooper for UFO enthusiasts. And I hope that anyone who has any reservations whatever about the reality of UFOs will get out there and read some of the UFO books – perhaps join one of the UFO organizations and get their newsletters – subscribe to UFO magazines. UFOs, like many other things in this world, become more real when you know more about them. You'll find very few wild-eyed believers or kooks involved with serious investigation of the UFOs – and you will find few who doubt their existence.

The more you read about UFOs, the more I think you'll find that my theory provides answers for all of the observed phenomena.

Some of the rarely seen UFOs are probably from even more remote times and since history has already been completely rewritten, they are probably back on some specific research projects.

HAM NEWSPAPERS

The other day some amateurs were telling me how profitable a ham-trade type newspaper was. I tried to explain that this type of publication looks like a winner – and it looks good enough so many have tried it – but the fact is that for some reason amateurs don't support them and they die when the bankroll dries up.

The recent demise of Radio Trade-Around out of Findlay, Ohio, is a case in point. This paper had a circulation of about 125,000 – and that certainly is impressive. But the actual paid circulation is reported by West Park Radiops (Cleveland) to have been about 3000.

Last year we saw the Ham Trader expire of similar causes – and back through history there have been countless others. Swap and Shop ran for several years before the moneybags shriveled up.

Apparently there is room for specialized newsletters which are put out as a hobby. I got started via that route with a radio Teletype bulletin way back in 1951! I ran that publication for four years, footing most of the bills myself and working up to a magnificent paid circulation of about 3000. The FM Journal, after several years of work, got up around that level too in the FM field. That was nowhere near enough to stay in business without a rich daddy – so it folded. Ditto RPT – and how many others?

It would seem that amateurs should make more of an effort to help new publications survive if they want to have them around. The subscription fees are not usually a hardship – and the more publications we have the better amateur radio will be. Is it really fair to have fun with amateur radio and not put something back into it in the way of support for publications? 73 will welcome comments, pro and con.

MIDCARS BAD GUY

After being asked to come to the Midcars meeting at Dayton to give a little pep talk to the group, I was virtually thrown out of the meeting by Midcars Czar K4DLA. He said flatly that he had no intention of permitting me to speak, even for a single minute.

Having run into this type of person at a few ARRL conventions, I was not

(W2NSD/1 continued on p. 94)

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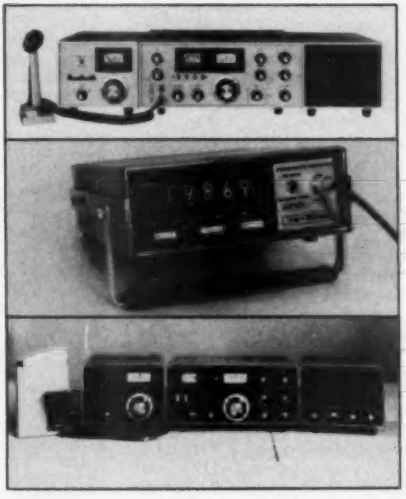

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MONO - BAND LOG - PERIODIC ANTENNAS PART I

For the past three years I have been testing Log-Periodic fixed beam antennas at this QTH. They have given excellent results – however they do require considerable acreage. This article describes smaller single band Log-Periodics which require less space than multi-band types but still retain the good forward gain, directivity, and the swr remains relatively flat across the entire band for which they are designed. They are easy to construct, are quite inexpensive and require no tuning or complicated impedance adjustments.

The original L-Ps used here were for multi-band operation on 20, 15 and 10, having 12 to 17 elements. This single antenna operates about equally well on each of the three bands. The measured gain was from 8 to 13 dB depending on their size (boom length), number of elements and its apex angle.

Figure 1 illustrates a typical Log Periodic covering the frequency range 14 to 30 MHz for operation on 20, 15 and 10. Most of these used here for different directions are 12 to 30 meters in length (boom length). They are mounted 12 to 15 meters above ground. The material cost is quite reasonable because of the wire construction, generally running from $12 to $25 each.

I have since designed and tested other Log-Periodics for 40, 20 and 15; 15, 10 and 6; 20 and 15 only; and more recently mono-band L-Ps for 40, 20, 15 and 10 which will be described. To date I have assembled and tested many of these for various frequency ranges and for various directions. All have been of the horizontal doublet type Log Periodic (DLP) configuration with the exception of one vertical mono-pole Log-P for 80, using radials for the ground plane or counterpoise.

Since over-the-air testing of the original Log Periodics generated considerable interest, many inquiries were received during QSOs and also by mail and phone calls inquiring if single or mono-band L-Ps are practical to reduce overall length for those primarily interested in single band operation. The answer is yes, and a mono-band L-P will still retain a gain of 8 to 10 dB in the forward direction (compared with a ½λ horizontal doublet at the same height), and the swr is relatively flat across the band.

Number of Elements Required

At least 12 elements must be used for a Log Periodic having a 2 to 1 bandwidth or one octave frequency spread, i.e., for operation on any frequency between 40 through 20; 20 through 10, etc. An L-P for a single band or a limited frequency range requires only 5 to 6 elements. I have even had good results using only 4 elements to cover the complete 20m band, 14.0–14.35 MHz. However there is an advantage from using an odd number of elements from a mechanical

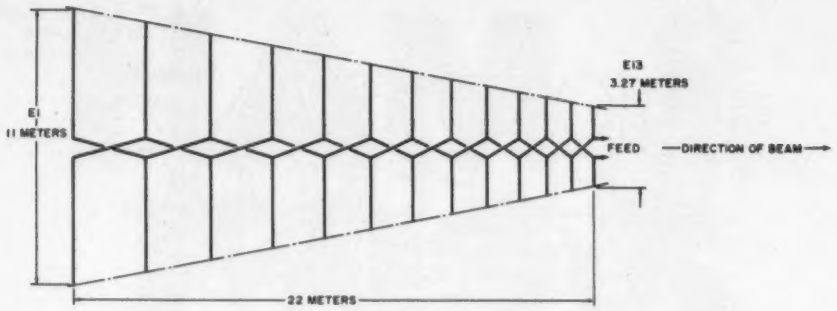


Fig. 1. Typical 2:1 bandwidth log periodic antenna, 14 to 30 MHz, for 10, 15 and 30 meters. $\alpha = 11^{\circ}$.

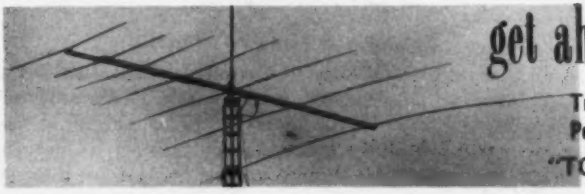
standpoint, as will be explained later. Therefore these L-Ps for mono-band operation all use five elements, as illustrated by Fig. 2.

Since high pine and cedar trees are used as "masts" to suspend the various antennas, the height above ground has generally been limited to 12 to 15 meters. Due to the arrangement of the trees, it was not practical to try a horizontal double type (DLP) on 80 as the height would have been limited to 12 meters, which is insufficient to realize full gain. For operation on 80 the vertical mono-pole L-P configuration mentioned above was tried. Since only ¼λ vertical radiators are used for this antenna, less height was required. Further, the vertical type gives a lower angle of radiation, better suited for longer haul circuits. This antenna is not described here; however the data on bandwidth, etc., obtained from the 80m test was sufficient to provide information to give the various dimensions for the horizontal DLP configuration for 80, should anyone have the space and support height (at least 19 meters) to use one to advantage. The listed swr readings for 80 were from the mono-pole type, but should be about the same for the doublet L-P.

All of the other mono-band Log Periodics for the higher bands were tested at a height of 12 to 15 meters above ground and a recommended minimum height is given for each band in the Table.

Theory of Operation

The theory and design of Log-Periodic antennas is rather complex. As this information and the design formulas have been presented in several amateur publications, it will not be repeated here. The best article on design formulas was "The Design of Log Periodic Antennas" by A. E. Blick VE3AHV, in the May 1965 issue of *73 Magazine*. Although this primarily covered VHF L-Ps for the 50–54 MHz band, the formulas hold for HF as well. The dimen-



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sions of the Log-Periodic antenna are such that the electrical properties repeat with the logarithm of the frequencies.

In effect, these antennas are a broad band unidirectional end-fire array. For those more acquainted with the yagi, you might consider the five element mono-band L-P illustrated by Fig. 2 as having a ½λ driven element (#2), a longer driven reflector (rear element #1) and three shorter driven directors, elements #3, 4 and 5. These are fed by a two-wire open center feed line which is in turn fed at the forward or short element end as shown.

It will be noted that transposition takes place between adjacent elements. Further for a single band it is possible to space the elements so that the main element, #2, is approximately ¼λ from the shortest forward element, #5. This simplifies the method of feed or impedance match at the feed point as will be explained later.

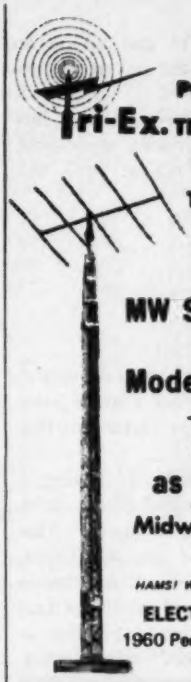
From the formulas given by K4GYO in his article on L-Ps in the October 1967 issue of *73 Magazine*, it is noted that the design of Log-Periodics is not simple. As all dimensions for element lengths and element spacings are given by this article, no math is required if these dimensions are followed.

Feed Method

The easiest method of feeding the mono-band Log-P is by means of a 4:1 balun with the high impedance balanced input connected directly to the center open wire feeder at the short element or input end, then to coax to the shack. The latter can be any required length.

It was found that the impedance at the center of the ½λ element #2 is in the order of 30 to 33Ω as measured with an Omega Antenna Noise Bridge. The ¼λ open center feeder between element #2 and the short element feed point acts as an impedance transformer with the feed point being in the order of 200 to 300Ω which is easily matched by the balanced input of the 4:1 balun, and in turn to the coax. On 40 the swr across the band measures as follows:

7.0 MHz	–	1.05:1
7.1 MHz	–	1.05:1
7.2 MHz	–	1.01:1
7.3 MHz	–	1.1 :1



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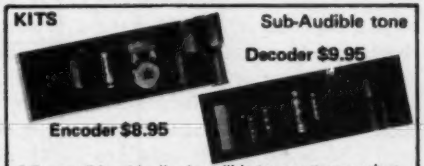

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The swr for the 10, 15 and 20 meter equivalent mono-band L-Ps are similar to those on 40.

Although an 80m mono-band DLP has not been tried, the equivalent mono-pole configuration mentioned above gave the following swr readings:

3.5 MHz	–	1.2:1
3.6 MHz	–	1.2:1
3.7 MHz	–	1.1:1
3.8 MHz	–	1.2:1
3.9 MHz	–	1.4:1
4.0 MHz	–	1.25:1

This will illustrate the broad-band nature of the Log-Periodic (even for a single band type) which is an excellent feature of this type antenna.

Another simple method of feeding a mono-band L-P is by a tuned feeder from the shack end to the input of the L-P. This eliminates the expense of the 4:1 balun. However, a "match box" or other tuner is required between the set and the tuned line. For a multi-band L-P, the 4:1 balun is simpler as the tuner requires retuning when shifting bands, making it necessary to adjust two or three additional controls. This is not objectionable for single band operation, but is a nuisance if you shift bands frequently. If not already on hand, the tuning unit will probably cost as much if not more than a 4:1 balun.

Test Results

Most of the testing on the mono-band Log-Periodic here has been on 20 and 40. Both give a very consistent 10 dB gain in the forward direction. The one for 20, beamed at 150 degrees, was used for several months, keeping test schedules at noon several times a week with my friend YV5DLT in Caracas. Most of the original 20-15-10m L-Ps had also been thoroughly tested with this station. He has been of great assistance in giving very accurate evaluations of these antennas. During the years we have been testing these, I have kept the same non-gain antennas used as "standards," for comparison with the L-Ps. By this procedure we have been able to obtain very accurate comparisons.

Most of the testing on the 15m L-P was also conducted with YV5DLT and other South American stations with similar results to those on 20.

One of the 40m mono-beam L-Ps is beamed south, and almost daily tests have been made with my friends W4QS and K4FBU in Florida over the past year. I use a good 40m doublet as the "standard" which is at the same height as the 40m L-P. A coax switch allows instant switching between these antennas. The doublet is horizontal (not an inverted V) and is in the clear. It

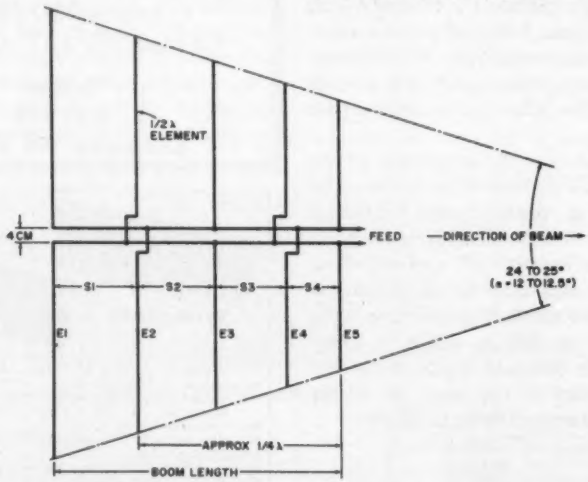

Fig. 2. W4AEO mono-band 5-element log periodic.

Table I

Band MHz	28.0–29.7	21.0–21.45	14.0–14.35	7.0–7.3	3.8–4.0	3.5–40	Notes
E-1	5.33	7.10	10.67	21.34	39.62	42.67	
E-2	5.10	6.86	10.06	20.12	37.79	40.84	
E-3	4.27	5.67	8.53	17.07	33.83	35.36	
E-4	3.73	4.97	7.47	14.93	27.43	30.48	
E-5	3.20	4.42	6.25	12.95	23.77	23.77	
S-1	1.07	1.43	2.13	4.27	7.92	9.14	
S-2	0.99	1.31	1.98	3.96	7.32	8.23	
S-3	0.92	1.22	1.83	3.66	7.01	7.32	
S-4	0.76	1.00	1.52	3.05	5.49	5.79	
Boom Length	3.73	4.97	7.47	14.94	27.74	30.48	
S2 +3 +4=	2.67	3.54	5.34	10.67	19.81	21.34	
Wire needed (Elements)	26.5	34	48	92	167	178	Note 1
Wire needed (Center feeder)	9	11.5	16.5	31	57	63	Note 1
Total wire	35.5	45.5	64.5	123	224	241	
Min. Ant. hgt.	10.6	12	12	12–15	20	21	Note 2
Opt. hgt.	21	21	21	43	40	43	Note 3

Note 1. These measurements include extra length for connections, etc.
Note 2. Telescoping TV masts suggested for higher bands.
Note 3. A height of 2 ½λ better for multi-hop paths.

All measurements are expressed in meters.

should be as efficient as most doublets. When my friends receive me S-8 to 9 on the doublet, they invariably report at least a 10 dB increase on the L-P; and often "20 over 9." These are consistent day-after-day reports. The "S" meter at this end also confirms this increase in received signal in the forward direction.

Three of the 10m L-Ps aimed in different directions have been used here for monitoring the AMSAT Oscar 6 satellite 10m downlink. These were compared with a 10m vertical ground plane about 10 meters above ground. It was found that when the satellite comes over the horizon in the beam width of one of the L-Ps, acquisition could be had about 5 minutes earlier on the L-P than on the vertical. As Oscar 6 approached an overhead or near overhead pass, the vertical is better. Then as it passed over, the L-P in the other direction could copy it a few minutes longer than on the vertical.

I wish to point out that the beam width of the L-Ps tested here are usually wider than a yagi, being about 100 degrees in width. This is good for a fixed beam which may be beamed for a certain part of the country or for those interested in DX from a certain continent.

On 20 my northeast Log-P seems to cover Europe quite well. The 150 degree beam covers Caracas and the east coast of South America. The south beam, South and Central America, and the west beam W6s, Australia and others to the west.

I can certainly recommend the Log Periodic for anyone having the space. From the dimensions in the table it can be seen that mono-band L-Ps for 10, 15 or 20 are entirely practical. Considering the gain possible for the moderate expense involved, it is felt that hams have been overlooking a good bet by not making more use of these very excellent antennas. 10 dB gain in a desired direction for $15 to $35 is not bad compared with the price of a linear having the same gain. This gain is also quite evident on the received signal. Further, it seems to have a diversity effect on receive when QSB is bad. As 3 to 5 dB is generally considered a fair antenna gain on 40 (2 extended ½λ in phase or a two element yagi) the 10 dB possible from a mono-band L-P is certainly worth considering.

Next month the step-by-step construction of a mono-band L-P will be presented along with mounting and testing details.

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A phase locked loop tone oscillator built in an old 6 transistor radio. The only external difference is the lack of a tuning capacitor and an added pushbutton.

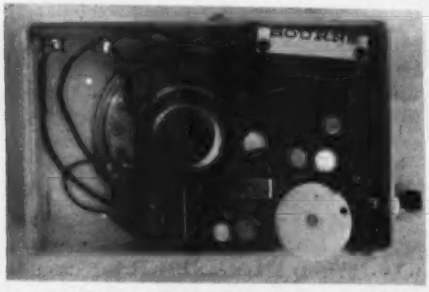
If you immediately understand $f_o \sim 2(V+ - V_c)/R_1C_1V+$; if you completely understand the theory of phase locked loops, and if you are not at all interested in a cheap and easy method of tone production for repeater entry, code practice, etc., then turn the page. This article is especially for people who want some easy fun putting an up-to-the-minute solid state device to practical use. The result is a stable, accurate, tone generator at a very low price.

The NE566 is called a Phase Locked Loop Function Generator. The phase locked loop has been explained in previous issues of 73. Near as I can figure, the function generator part means it's some kind of fancy oscillator. If you turn to the back of the magazine you will probably find them available for less than $5.00. If you order one you'll find that it's a lot smaller than a folded five dollar bill. Only seven other parts and any old transistor radio you might have in the junk box are needed. The 5 KΩ variable resistor can be any kind of miniature variable, but a ten turn trim pot allows easier setting of the tone. You'll also need some ferrite beads. These are inexpensive and can be ordered when you order the phase locked loop. No other exotic or difficult parts are needed.

I tried several oscillator circuits in an attempt to build a tone encoder for use on tone entry two meter repeaters. I ran into problems with impedance matching, rf stopping the oscillators, rf feedback, proper keying, etc. Also, I would have had to build several oscillators for all of my rigs including

A touch tone can also be used with a borrowed radio audio section. This unit does double duty with both a touch tone and PLL oscillator feeding through the same audio unit. Pushing the buttons is the author's wife, WA7NDK.

the portables. My solution was to use one atmosphere density acoustic coupling with an integrated humanoid digit for keying. In other words, I took all of the rf parts out of an old cheap six transistor Far East radio, poured the little oscillator in with the remaining audio circuit, put the microphone in front of the speaker, and keyed it all on and off with a pushbutton. The unit fits in my shirt pocket and I can use it with any rig I happen to be near. The six transistor AM radio is usually found in a drawer in almost everyone's house. It's the one you got for depositing $500 in a savings account or getting a red star on a cash register receipt. Maybe you bought it for the beach. Usually you find the battery has gone flat and often the rf sections have gone weak too. The audio sections, however, are almost always still good. They typically use a one transistor audio driver transformer coupled to two output transistors. Removing the rf portions of the circuit is easy. To prepare for this brain surgery first remove the radio circuit board from the case. Identify the volume control and tuning capacitor. Look for a wire running from the volume control over to the i-f part of the receiver. Make note of it because it carries your tone into the amplifier part of the circuit. Clip it where it connects with the i-f. Find a line halfway between the tuning capacitor and volume control from the top of the board to where it meets the speaker. Cut the board in half at this point. Put the rf part of the board and the antenna coil in the junk box. (Don't throw it away – it might conceivably have a use sometime in the next thousand years.)



The oscillator board is on the left. The remaining audio portion of the radio on the right. The three ferrite beads are on the plus lead to the oscillator. The audio output lead is the high quality connection on the top.

This home brew circuit board has a simple layout you may wish to copy. (Board by WA9FCG) The IC goes cross wise in the lower center. The resistors and cacpacitors go from island to island to make the proper connections.

When you cut the board in half, you broke a circuit that runs all the way around the outside of the board. Take a small piece of wire and re-connect the foil at the extreme edges where you cut it. Connect the very top foil line with the very bottom one along the cut. At this point you should be able to connect a fresh battery and hear a click in the speaker when you turn on the volume control. Hold on to the metal part of a screwdriver and tickle the wire coming from the volume control. If you don't hear any pops or sounds even when you click the switch, try and figure out what you did wrong and get the next radio. These six transistor radios are all remarkably similar on the inside, regardless of the case or brand name.

The parts of the oscillator can be mounted in any way. I used a board that WA9FCG had made at home. You can make your own, use perfboard, or put it on a small rectangle of shirt cardboard. Keep the leads short so that rf doesn't have a chance to sneak in. A piece of wet tissue on the pin near the body of the IC should keep it healthy if you solder directly to it.

Back at the radio, unsolder the battery lead that goes to the volume control switch. Find an open place and stick a small momentary contact push button switch in the radio case. Connect the battery lead to this switch and back out to the radio and oscillator. (Watch polarity! If they had the negative lead going to the switch then be sure and connect it to the oscillator ground side.) Slip three ferrite beads over the positive battery lead close to the oscillator. This keeps it from changing tone when you

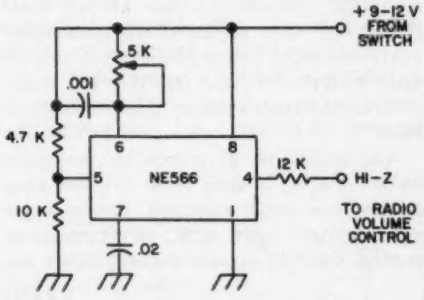


Fig. 1. Schematic of the tone generator.

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WA7NDK/1 squeaking into the W1QXR repeater. One tone burst unit can be used with every rig.

have it right next to the antenna. Connect the audio lead coming from the volume control to the output of the oscillator. Run a wire from the negative battery lead to the ground side of the oscillator. (Unless you have already connected the negative as above.) Set the tone control to mid range, turn the volume control on high, hook on a battery, and you should have a nice tone when you push the button. Another advantage of this system is that the tone can be set just by listening to somebody else's tone and using your perfect pitch to match them up.

The NE566 is rated for 12 volts, but they all seem to play fine on 9. Battery life is reasonable because of the limited time. Beware of some of the cheap momentary contact switches you can buy. Some of them make such poor contact that they throw in a different resistance every time you press them.

The technique of borrowing the audio section out of a little radio has also been used with a touch tone pad. This makes a nice portable unit with no connections needed. Chop up a radio and let yourself go.

. . .K9KIC

REFERENCES

Linear Integrated Circuits, Vol. I. Signetics Corp.

Thomas P. Litty, President
TPL Communications, Inc.
13125 Yukon Avenue
Hawthorne CA 90250

THEORY AND DESIGN OF VHF&UHF AMPLIFIERS UTILIZING RF POWER TRANSISTORS

Almost all rf power transistors in general use today are of the balanced emitter silicon planer type. In essence this means the transistor is constructed of silicon material utilizing a planer process with all emitters stabilized by resistors.

NPN and PNP transistors are both available for use as rf power amplifiers. This is largely due to the fact that Motorola C & E, the largest user of rf transistors in the world, designed their high band VHF Micro Radio with the PNP variety. If it were not for Motorola, therefore, there would be no need for PNP transistors, since they offer no advantage over the NPN and in fact are slightly more difficult to build and use.

The NPN transistor is built using a doped silicon wafer. The wafer is doped to form a high conductivity layer, now as an epitaxial layer, on one side, and a Si 0_2 glass layer on the opposite (see Fig. 1).

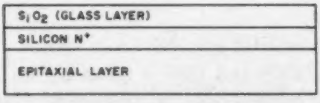

Fig. 1. Silicon wafer, side view.

Using a photographic process, the Si 0_2 layer is imprinted with a base mask. This mask is actually a photograph of the base region of the transistor (see Fig. 2).

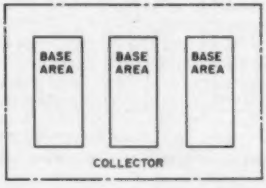

Fig. 2. Top view of base area mask for a single transistor.

This base area is then etched out of the Si 0_2 using hydrofluoric acid. A Boron gas is then passed over the open areas. The Boron gas dopes the open area positive (since this is a NPN transistor) and forms a positive base region (see Fig. 3).

It might be well to mention at this point that a single silicon wafer (2–5 cm diameter)

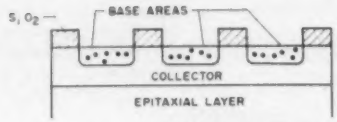

Fig. 3. Side view of a single transistor, showing base diffusion.

usually contains hundreds, if not thousands, of individual transistors.

The holes cut for the base area diffusion are then filled up by ethyl silicate, a substance similar to $Si\ 0_2$, and new holes cut for the emitter regions by the same process as that used for the base.

The emitters can then be diffused through these holes using a gas containing phosphor (see Figs. 4 and 5).

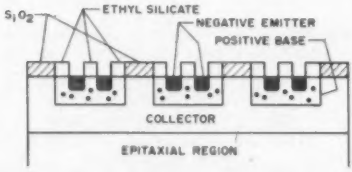

Fig. 4. Side view of a single transistor, after emitter diffusion.

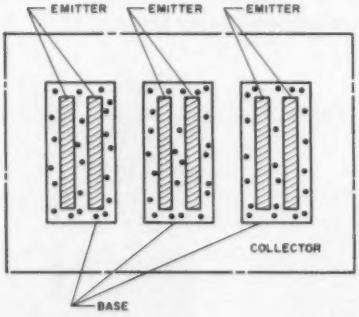

Fig. 5. Top view of collector emitter and base areas of a single three cell transistor on a silicon wafer.

A very important question should now have entered your mind. How do we connect all of the base and emitter areas together and to the outside world, so we can do something with the transistor besides look at it?

The connections are made by an aluminum metalization surface which is deposited and then etched to form contacts between all emitter and all base areas. Gold is being used in place of aluminum by some manufacturers because of its ability to extend the transistor life during high temperatures.

It is at this time that the emitter balancing resistors – among the more common are nichrome and aluminum – are deposited (see Fig. 6).

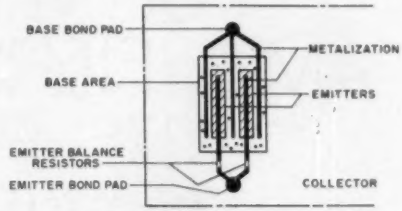

Fig. 6. Top view of one cell of a transistor with metalization and emitter resistors.

When the wafer has reached this point it is diced up, forming thousands of individual chips identical to the one I have been describing.

Connections to the outside world are now made by fine gold wires connected from the base and emitter bond areas to the respective transistor package terminals.

Collector contact is made through the bottom of the transistor chip which mounts to a metalized beryllium oxide wafer (see Fig. 7).

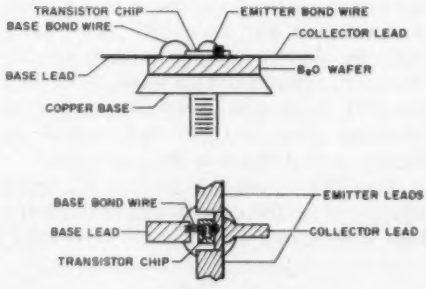

Fig. 7. Transistor

VHF and UHF

At VHF and UHF a transistor no longer looks exactly like a transistor. Figure 8 depicts the equivalent circuit.

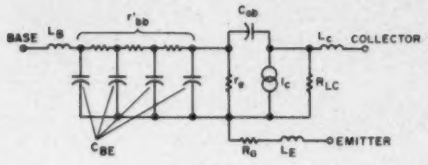

Fig. 8.

Once we understand what the transistor looks like, it is possible to design a circuit that will give optimum performance.

Circuit Design

As we have seen from the equivalent circuit of Fig. 8, the transistor at VHF and UHF cannot be viewed simply as a current amplifier since it possesses too many reactive components to make life that simple. The solution therefore must be to impedance match the rf power (rf current if you wish) in and out of the transistor. To do this with the minimum of effort, we may simplify our equivalent circuit to the extent shown in Fig. 9.

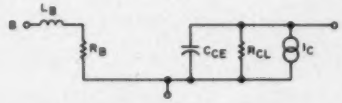

Fig. 9.

I will also make another assumption, and that is that all system work done with these amplifiers will be 50Ω.

Base Matching

To match the base of the transistor to 50Ω, it is often advisable to resonate out the base inductance L_B at the operating frequency or its second harmonic. For simplicity we will resonate it at the operating frequency as follows:

1. Obtain the parallel equivalent circuit for L_B and R_B:

$$Q = \frac{X_{LB}}{R_B}$$

$$R_{BP} = (1 + Q^2)\, R_B$$

$$X_{LBP} = \frac{(1 + Q^2)\,(j\, X_{LB})}{Q^2}$$

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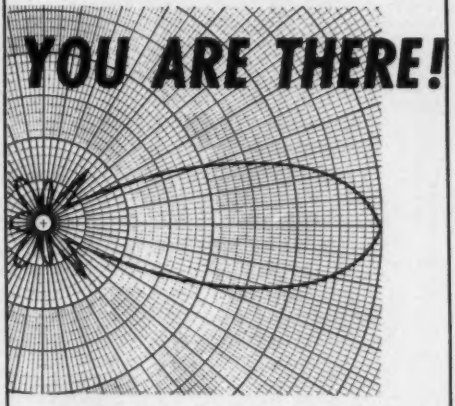

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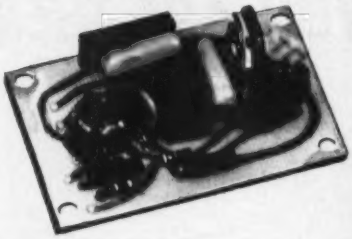

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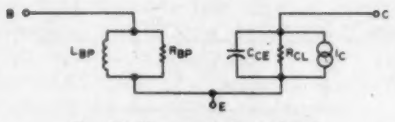

Fig. 10. New equivalent circuit.

2. By selecting a capacitor with a value – jX_{LBP} – we can resonate out the base inductance. The capacitor is placed as shown in Fig. 11a.

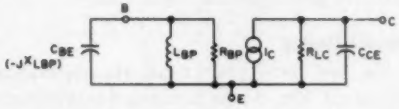

Fig. 11a.

With C_B now in place our circuit looks as depicted in Fig. 11b.

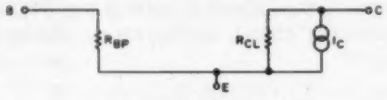

Fig. 11b.

3. We now may match the input impedance to 50Ω by using the simple impedance matching network shown in Fig. 11c.

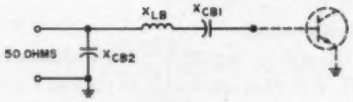

Fig. 11c.

X_{CB1} is simply a Q multiplying capacitor which also allows adjustment to the circuit should any be necessary.

The values of the components can be computed as follows:

$$Q = \sqrt{\frac{50}{R_{BP}} - 1}$$

(Use this number for solving equations below.)

$$X'_{LB} = Q\,(50)$$

$$X_{CB1} = .5\,(X'_{LB})$$

$$X_{CB2} = X_{LBP} = \frac{(Q(50))\,(1+Q^2)}{Q2}$$

Collector Matching

To match the collector output to 50Ω we proceed as follows:

1. Determine collector load impedance as per this formula:

$$R_{C}1 = \frac{V_{CC}^2}{2\,Po}$$

2. By using the following simple circuit (see Fig. 12), we may match the collector load impedance, R_{CI}, to 50Ω. This assumes you are developing enough power to make R_{CI} less than 50Ω., i.e. appx. 1.4W @ 12V. If this is not the case, other simple variations of this circuit can be used, for example, reverse it.

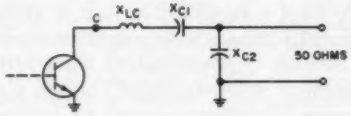

Fig. 12.

Calculations for X_{LC}, X_{CI}, and X_{C2}.

$$R_{CL} = \frac{V_{CC}^2}{2\,Po}$$

$$Q = \frac{50}{R_{CL}} - 1$$

$$X'_{LC} = Q\,R_{CL}$$

$$X_{LC} = 1.4\,(X'_{LC})$$

$$X_{CI} = .4\,(X'_{LC})$$

$$X_{C2} = \frac{(1 + Q^2)\,(X'_{LC})}{Q^2}$$

The only step left is to provide dc voltage for the amplifier. This is done through a dc isolation choke of approximately five times the collector load impedance. Some base to ground dc connection should also be provided to eliminate high standby leakage currents and to prevent the rf input power from biasing the transistor off (loss of power gain will result). See Fig. 13.

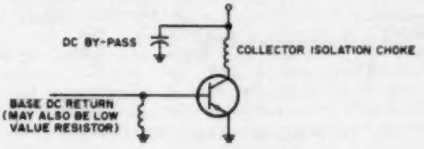

Fig. 13.

The collector choke should be heavily bypassed, on the dc side, to eliminate oscillations and rf feed-through into the rest of the system.

Practical VHF and UHF Amplifiers

I am going to describe several simple designs that will make any VHF or UHF transistor play quite well and explain how you can optimize them for best performance.

This amplifier will work with any VHF transistor whose power output is between 3 and 40W.

Some of the more common transistors that can be used and their respective power gains are listed in the table.

Power Output	Power Gain	(Mfr.)	Type
3–5W	10 dB	TRW	2N5589
		TRW	PT5589
		SSS	2N6080
		CTC	B-2-12
7–12W	6–8 dB	TRW	2N5590
		SSS	2N6081
		CTC	B-12-12
10–18W	8–10 dB	SSS	2N6081
		TRW	PT5649
		CTC	B-12-12
20–30W	5–8 dB	SSS	2N6083
		TRW	2N5591
		SSS	2N6082
30–40W	4–7 dB	SSS	2N6084
		TRW	2N5706
		CTC	B-40-12

Referring now to Fig. 14, these transistors will work quite well with the suggested values and if you follow my tweaking

(cut-and-try) suggestions, will result in an exceptionally well-performing amplifier.

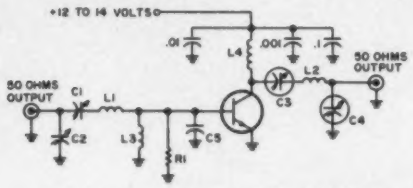

Fig. 14. Frequency range, 140–175 MHz.

C1, C2, C3, C4 – ARCO 404
C5 – 100–150 pF
L1, L2 – 3T #16 0.7 cm I.D.
L3 – 3.3 μH rf choke (appx.)
L4 – 5T #18 0.7 cm I.D.
R1 – 10–500Ω

To tune this amplifier, apply voltage and tune C1 and C2 for minimum reflected power, then adjust C3 and C4 for maximum power output. To tweak this amplifier simply adjust L1 and L2 until C1 and C3 are almost completely meshed for maximum power output and minimum reflected power. Adjust R1 until the output power drops about 5–10% and you are ready to go.

A simple explanation of why we tweak in this way now follows: a) C1 and C3 are made as large as possible to bring the loaded Q down, thus increasing the bandwidth and stability of the amplifier. b) R1 acts as a stabilizing element, swamping and terminating the input circuit so that mis-adjustment will not cause oscillations.

Important Construction Techniques

The following are some very important suggestions that can make or break you as an amplifier builder. If you follow these suggestions in building the latter described amplifier, you should have little difficulty in making it work.

1. Keep the leads as short as possible on all dc bypass capacitors.

2. Keep the leads as short as possible on C5 and place it as close to the transistor base lead as possible.

3. Keep as much ground return area as possible, preferably by using double sided board.

4. Keep the emitter leads on the transistor as short as possible.

5. Follow my suggested circuit layout for maximum success.

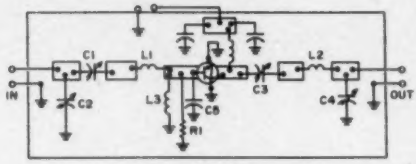

Fig. 15. Suggested circuit layout.

6. Thin copper coil should be used to connect the top ground plane to the bottom ground plane around the emitters, dc bypass and rf input and output.

How to Get More Power and More Power Gain

Now that we have mastered the single stage amplifier the next step is to combine these amplifiers to provide more power gain and/or more power handling capability. Figure 16 is a suggestion of how to cascade and parallel these simple amplifiers to provide 80W of rf power output from 3/10W power input. A handy widget, known as the Wilkenson Combiner, is used to split and combine power. This device utilizes the simple quarter wave transmission line formula for its operation.

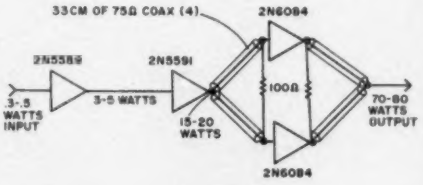

Fig. 16.

Good heat sinking should be provided and the power transistors not stressed mechanically in any way, since they are brittle and once broken, are useless.

The rest is up to you. Packing and utilization of these simple circuits is limited only by your imagination. Remember, the simpler, the better.

. . .K6RAD

220 - GOING... GOING... GOING...

Before the
Federal Communications Commission
Washington, D.C. 20554

FCC 73-600
97345

Docket No. 19759, RM-1633, RM-1656, RM-1747, RM-1761, RM-1793, RM-1841.

In the Matter of The creation of a new class of Citizens Radio Service and the reallocation of frequencies between 224 MHz and 225 MHz in the band 220–225 MHz now allocated for shared use by stations in the Amateur Radio Service and Government Radiolocation Stations for that purpose.

Notice of Inquiry and Notice of Proposed Rule Making

Adopted: June 6, 1973 – Released: June 12, 1973.

By the Commission: Commissioners Johnson and Reid concurring in the result.

1. Notice is hereby given in the above captioned matter.

2. The following petitions have been received which are applicable to this matter:

a. RM-1633 (Wayne Green petition) filed May 25, 1970 – Proposes to make part of the 220 MHz amateur band available for "Hobby Class" amateurs and to limit 27 MHz Citizens Band operations to "business and personal business" use.

b. RM-1656 (Reed Electronics School petition) filed June 24, 1970 – Proposes to move Citizens Band from 27 MHz to the 220 MHz amateur band and to return 27 MHz frequencies to U.S. Government.

c. RM-1747 (EIA petition) filed February 5, 1971 – Proposes a new "Class E" Citizens Band service between 220 and 222 MHz; 80 channels; 25 kHz channels; 100 watts maximum power. Would not alter Rules for 27 MHz Citizens Band.

d. RM-1761 (F.C. Hervey petition) received February 26, 1971 – Proposes to shut down 27 MHz Class D Citizens Band as now provided in "Parts 95 and 15" temporarily and reassign frequencies "to those Mobile Radio Services in greatest need;" and to create a new "Hobby/Personal Radio Service" in parts of the 220–225 MHz band as a substitute for present Class D Citizens Band.

e. RM-1793 (George Jacobs and Stewart Meyer petition) filed May 10, 1971 – Proposes to establish a new "VHF Radiotelephone License" in the Amateur Radio Service anywhere above 144 MHz (suggests 221–224 MHz); phone only; 100 watts maximum power; no code test. Would not change Citizens Band rules.

f. RM-1841 (United CB'ers of America) filed July 1, 1971 – Proposes to use 27 MHz for "Hobby (Class H)" use only; transfer "all emergency and call channel operations" to 220 MHz.

3. All of the foregoing petitions propose, in various ways, Citizens Radio use of a portion of the band 220– 225 MHz and will be considered in this proceeding. The most detailed petition was submitted by the Electronic Industries Association (EIA). As proposed by EIA in RM-1747 a new Class E category in the Citizens Radio Service would be created for the same type of use now authorized to Class D category stations, i.e., personal and business radiocommunications. As proposed, the Class E category would provide 80 FM channels occupying 2 MHz within the 220–225 MHz frequency band. Channels would be allocated for specific types of communications, e.g., intra-station, inter-station, business, weather advisory, emergency, marine, in-plant, traffic control, etc. Most Class E stations would be authorized 25 watts power output. A small number of channels would be reserved for one watt, local use stations. Certain public safety agencies would be licensed to operate Class E stations at 100 watts for use in emergencies. Antenna structures could be either 20 feet above the nearest man-made or natural object within 500 yards, or 60 feet above existing terrain. Licensees would be required to notify the Commission and the Federal Aviation Administration should antenna height exceed the maximum permitted near airports. The petition proposes a simplified licensing procedure which includes self-assigned station call signs. The petition further proposes that a station could be placed into operation immediately upon filing of the application and, should the Commission fail to act upon the application within 30 days, the license would automatically become validated. While the petition does not contain an estimate of the size potential for the proposed Class E category, informal estimates run as high as 10 million licensees. The Commission is also in receipt of considerable correspondence both in favor and in opposition to the reallocation of the band for any uses other than are now authorized. The American Radio Relay League, Inc., (ARRL) has filed a petition in opposition to that of EIA (RM-1747) requesting denial of the EIA petition and that the Commission issue a notice of inquiry inviting suggestions and proposals for increasing the efficiency and effectiveness of the Citizens Radio Service.

4. The band 220–225 MHz is currently allocated internationally in Region 2 to the Amateur and Radiolocation services on a co-equal basis. Nationally, however, Radiolocation is the primary service and Amateur the secondary service. The latter service is further constrained by footnote NG13 to the national Table of Frequency Allocations specifying that in an area in Texas and New Mexico about 175 miles wide and 110 miles in latitude centered essentially on the White Sands Missile Range, normal amateur operations are not permitted in the band between 5:00 AM and 6:00 PM, Monday through Friday. In view of the Government use of the band for radiolocation, the Commission has inquired as to the possibility of the band being shared with some form of Citizens Radio Service operations. The Director of the Office of Telecommunications Policy has advised that sharing to accommodate additional operations of a disciplined Citizens Radio Service would be practicable in the band 223–225 MHz. Such use would be subject to reception of possible interference from radiolocation operations, particularly in coastal, North Central and the North-

". . .220–225 MHz is currently allocated internationally in Region 2 to the Amateur and Radiolocation services on a co-equal basis. . ."

western areas of the United States. Moreover, operations would not be permitted between the hours of 5:00 AM and 6:00 PM, Monday through Friday in the areas around the White Sands Missile Range, New Mexico, and in Franklin and Gulf counties in northwest Florida.

5. As implied above, the use of a portion of the band 220–225 MHz for other than Amateur or Radiolocation services would be a derogation of the international Table of Frequency Allocations of which the United States is a proponent. Therefore, it is possible that objections from Canada and Mexico may require a prohibition against any other operations in some border areas. Pending resolution of that matter, mobile stations would be constrained from operations within ten miles of the border and base stations within 25 miles of the border. If suitable arrangements with Canada and Mexico can be effected, this prohibition may be modified to conform to the nature of the agreement.

6. The Citizens Radio Service was established by the Commission in 1945 (Docket No. 6651) as a radio communication service of fixed, land, and mobile stations intended for short distance personal or business communications, and for radio signalling and control of remote devices by radio. Due to a lack of suitable low cost equipment for the then existing Classes A, B, and C services, Citizens Radio grew slowly and reached a total of only 40,000 licensees by 1958. At that time it was decided to establish a Class D Citizens Service in the 27 MHz region to permit voice communications of a general or business nature. Although interference had to be accepted from Industrial, Scientific and Medical (ISM) equipment, to which the frequency of 27.12 MHz was primarily allocated, it was believed the Citizens Radio Service, due to its relatively low priority, could nevertheless make effective use of the spectrum. Consequently, although not ideally suited to the short distance concept of the Citizens Radio Service because of its sporadic long distance transmission characteristics, the 27 MHz region was allocated for such use. It was expected that equipment operating in the 27 MHz band could be produced at considerably less expense than equipment operating in VHF or UHF bands. Growth has been phenomenal, with the number of licensees increasing from 49,000 in 1959 to 868,013 in 1971.

7. The 27 MHz Class D Citizens band is divided into twenty-three channels with seven channels authorized for communications between units of different stations and one channel to be used solely for emergency communications involving the immediate safety of life and the immediate protection of property, or communications necessary to render assistance to a motorist. A wide variety of communications is permitted in the Class D Citizens Radio Service. As the number of licensees increased, however, so did complaints against the use of the service for the transmission of long duration base-to-base messages, hobby type communications, technical violations such as use of high powered amplifiers, and general pollution of the spectrum. Such abuses resulted in certain prohibitions against the Class D CB Service, including: (1) communications as a hobby or diversion; (2) transmission of obscene, indecent or profane words, language or meaning; (3) communications not directed to specific stations or persons; (4) the transmission of advertising or soliciting the sale of any goods or services; (5) transmission of music, whistling, sound effects or any material for amusement or entertainment purposes; (6) communications about the technical performance of equipment; (7) relaying messages for a person other than the licensee or member of his immediate family.

8. The Commission has been examining a number of various proposals directed toward promoting the effective use of the Citizens Radio Service or reducing widespread Rule violations. These proposals will be the subject of further Commission inquiries and proceedings with regard to Class D enforcement problems. The immediate proceeding, however, will address only the possibility of allocating additional frequencies to meet the requirements of the general public for improved radiocommunication services not now effectively provided by the Class D Citizens Radio Service and, at the same time, relieve some of the heavy concentration of stations on channels available to the Class D service. Such stations constituted nearly 47% of the total number of radio stations authorized by the Commission, as of June 30, 1971.

9. The Commission proposes in this proceeding to establish a form of fixed and mobile service in the band 224–225 MHz. The band would be divided into 40 channels at 25 kHz spacing. Eligibility for this service would be similar to that for the present Class D service, i.e., any person eighteen years and older who meets the basic criteria for Commission licensing. However, the Commission does not intend that the abuses of its Class D rules, and associated enforcement problems, shall be extended to this new service. Accordingly, before this service is permitted to become operational the Commission will establish new Class E rules and enforcement procedures, based on the information provided in response to paragraph 10 of this Notice and such other relevant information as it deems appropriate.

". . .the Commission does not intend that the abuses of its Class D rules, and associated enforcement problems, shall be extended to this new service."

10. With a view toward achieving the above objectives regarding the reallocation of the band 224–225 MHz specific comments and substantiating data are invited on the following:

a. Specific services and types of operations which should be provided, including limitations and reasons therefor. Estimated growth over 10-year period.

b. Economic sociological and other public interest benefits which would be derived.

c. Effect on Class D Citizens Band operations at 27 MHz.

d. Nature and probable impact of operational limitations imposed as a result of interagency and international objections or conditions of use.

e. Detailed technical parameters which should be adopted regarding equipment to be used, including detailed studies of extent of effective coverage and use to be expected in different environments such as urban areas with high density population. In addition, detailed recommendations should be made regarding total spectrum space required to meet various objectives, channeling, maximum power, an-

(con't. on page 91)

Bill Hoisington K1CLL
Farover Farm
Peterborough NH 03458

THE AMATEUR'S INTERCOM

A duplex intercom that operates on broadcast frequencies.

This article concerns a very useful item in anybody's shack or home, namely a two-way duplex radio type intercom that you will have a lot of fun making, tuning up and using. Most of the parts should be found in your junk box (mine is about 45 feet long now, but I have been at it for half a century, this year).

This project will take you right back to the good old days of 160 meters, even if you've never been there before. It's an "MOPA" (master oscillator-power amplifier) and it's on 160 meters. To be exact, one part is on 1600 kHz which, when I got my first license in 1923, was called "200 meters," and the other half is close to the good old ship band of 500 kHz.

The two receivers needed are already complete for you. If you think you can build them for *less* than $4.95, go ahead and try! Otherwise just buy two of them at Lafayette or Radio Shack. I did, and aside from the misery of the tiny edge-tuning dial, they do the job. Of course, for around $8.95 you can go hog-wild today and get "Direct Dial Tuning" and a "Large Three Inch Speaker!" (Just how large can a three-inch speaker get to be, anyway?) The sending units are easy to make, easy to tune up, easy to modulate and have a terrific collector dip, after the sometimes skimpy ones on VHF-UHF. Then you load up with the ac line plugged into the final, and you're in business. Your XYL should appreciate *this* one at least.

Bear in mind that on this project you *can* substitute almost anything.

Transmitter

So here we go. Figure 1 shows the schematic of one transmitter. The layout can be your own. I built mine in a black plastic piece of pipe and just plugged it in like a long light bulb. Nothing touchy about the circuit. The master oscillator oscillates and the power (99 mW!) amplifier amplifies. Q1 and Q2 are any old transistors that reach 30 MHz, or even good audio ones. I happened to have some 2N4249's and they worked well at 1600 kHz, so in they went. I also tried some VHF units, HEP 55's to be specific, and they were too lively for use at those low frequencies. Q1 is the oscillator, with emitter feedback from L1. L1 is No. 34 DCC (double cotton covered) with coil wax to hold it in place on a phenolic form about ½ cm O.D. and about 2.5 cm long with a threaded core inside. BC "loopsticks" are good, except for the taps. In fact you can use almost any kind of coil as long as you keep the turns ratios nearly as shown. Don't forget, you are on 200 meters, the high end of the BC band, and you can use plenty of C. I sometimes use up to 1000 pF around these frequencies.

Transistor Q2 is the amplifier and serves mainly to take the AM modulation. I tried to make the project go with a modulated oscillator, but zilch. No getting away with it. Just combined FM and AM with nothing in the center of the carrier and some kind of modulation on either side. You will find that

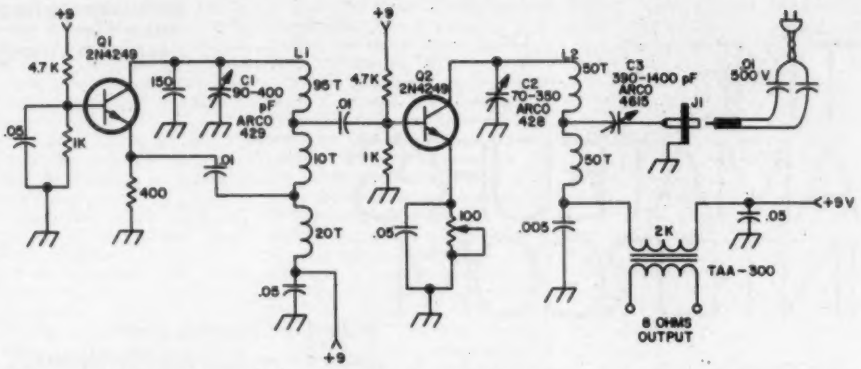

Fig. 1. Schematic of the 1600 kHz transmitter for the intercom. To get the second unit operating on 550 kHz, turns may have to be added to L1 and L2 – just be sure to keep the tap ratios the same.

Q2 works just the way the old tube sets used to. Remember those large old glass bottles your father worked with? When the oscillator Q1 is loaded into Q2, you can get up to 15 or 20 mils of collector current on Q2. Then when the circuit C2-L2 is tuned to 1600 kHz, a fine dip occurs, way down to a few mils. You can then load it back up with useful energy into the line, or a test lamp, to 10 mils, or even 11 if you want to get the maximum allowed which is 100 mW. So with 9V you've got 99 mW.

You will be surprised, if you haven't tried it already, how you can load up your ac line with BC rf! The carrier will then be found all over the house, along with the really good modulation, if anyone is talking. The signal also goes to the cellar, garage, workroom or what have you.

Ac Supply

Just in case you don't have one lying around, or don't have an old defunct $9.95 ac-battery portable that you can survey, Fig. 2 shows an ac supply that I rigged up in an emergency. It works and doesn't have any hum in it that I could find, even when I used

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80 Meter Range in FT-243	2.50
Color TV 3579.545 KHz (wire leads)	1.60 / 4 for 5.00

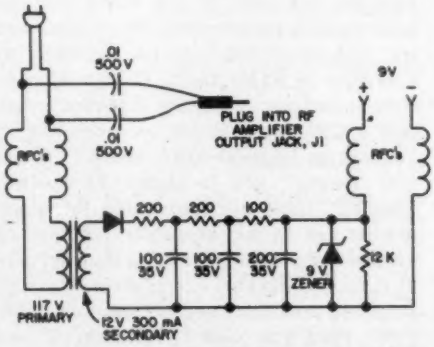


Fig. 2. A power supply that is built into the same case with the transmitter furnishes power while also connecting its output to the "ac line" antenna.

it with a 108 MHz FM oscillator-modulator combination. I did try for a minimum value of capacitors while still maintaining an absence of hum, just as a matter of cost, but again, it works. In this case, for radiation, you just plug the rf output right back into the ac line, which goes all over the house.

Receivers

I just went to one of the Radio Shacks and paid $9.90 for two of those 6 transistor radios with a 9V battery and a carrying strap (which I soon cut off because it's a nuisance). As mentioned, for around $10 each, you can do better, but these little $5 jobs have a certain feature which is quite interesting. As far as I know, they represent the greatest value of anything our technological world has produced so far – a sensitive superhet covering a frequency range of three to one, complete in a palm-size box, antenna, battery, etc., all for $5. They do require a "stand" though, to make them sit up on a table or shelf.

Modulator

I used the same dependable Amperex TAA-300 IC whose circuit is about ten years old by now and is well known to readers of *73 Magazine*. You can also use any of the solid state audio amplifiers, 100, 360 mW output, or 1W or 3W, for $4.95, $5.85, etc. Or build your own from your favorite chip. With the TAA-300 output of 8Ω I used an 8Ω to 2 KΩ transformer, as in Fig. 1. You can use the same, or adjust an op amp output to around 2 KΩ, and modulate the final with that. Use any mike you please, beginning with the 1½ in. crystal mike cartride for 89¢ at Radio Shack. For hi-fi(?) response, use one of these in parallel with their dynamic mike cartridge. You might, just might, be surprised. Just listen to the modulator output direct into padded earphones. Again, Radio Shack, for less than $20, and very useful (no, I *don't* work for Radio Shack).

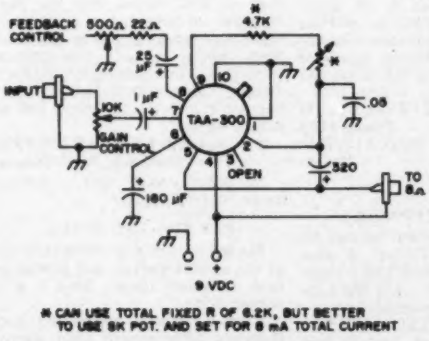


Fig. 3. The TAA300 IC was used for modulation, but any small amplifier will work equally well.

Testing

You should get enough rf output out of J1 to light a No. 48 bulb (2V, 60 mils, 120 mW). Maybe not too bright, but visible enough. Perhaps 50 mW, for example. The amplifier should also load well into the ac line with judicious use of C2 and C3. Run the amplifier with just a slight dip, but always *listen* to it. I use two methods, sometimes three. 1) Plug a good set of padded earphones of the hi-fi type which have two little loudspeakers inside into a good receiver and listen to it. 2) You can plug a good FM set into the modulator input for tests and listen around the house for field strength. Don't take the modulation for granted. Use a good AM set for these tests. 3) Use a diode receiver with good af.

As a final test, do the same with one of the $5 sets. For duplex tests, tune up a second sender on or near 550 kHz, and use the second $5 receiver. You may have to increase the number of turns on L1 and L2 for this. A BC loopstick will always do it if you don't want to wind your own, but you'll have to rewind for taps. Now plug one transmitter into the line in your shack, for example, and the second in the kitchen or near the TV set if your XYL is a soap opera addict, or even in the library if she is the intellectucal type – and, *voila*, DUPLEX. You will find you can talk most anywhere in a room and the mike will pick it up. Use lots of modulator gain and only a little on the receiver, to keep sound wave feedback down. There is also one of those miserable little earphones with each $5 set, if you can stand it plugged into your ear. Have fun – that's what this one is all about!

. . .K1CLL

LETTERS

ou goons don't ever proofr
lousy [illegible] from bob
bunch of rocks [illegible] on
you ignored my comments in
I insist that you print ev

FM OPTIMISM

Having lived for the past 2½ years alternately in blighted parts of the country where there is no 2 meter activity, and in parts of the world where there is no ham activity at all, I have watched the FM scene develop through the pages of 73 with great interest and a growing desire to join the fun when I return to the states. At least that was true until a few months ago when the new repeater rules were released. The results of this stultifying act are starting to come in, none of them good. FM will of course carry on somehow, but what is left may not be worth bothering with. Either FM as it is known or the FCC is going to have to give, and when was the last time that you remember a government bureau admitting a big mistake was made?

Alan P. Biddle WA4SCA/BV2
APO San Francisco CA

RTTY GEAR NEEDED

Would appreciate being put in touch with an RTTY ham who would be willing to ship some gear out here. That is, to organize the purchase, etc., of the gear and on receipt of my cheque to ship it out.

Very little RTTY gear is available out here.

Appreciate 73 very much.

A. A. O'Brien VK2BOA
P.O. Box 57
Port Stephens Street 2324
N.S.W. Australia

FCC DIRECTIONLESS?

A funny thing happened to me on the way to my repeater license (WR7ABA). After two months of waiting and no word from the FCC, other than my cancelled check, I received a collect, long distance phone call from Rick Hambly who is secretary of the Tompkins County Radio Club in Ithaca, New York.

He informed me that they had just received their new repeater call from the FCC (WR2ABD) and as a bonus the Commission had included my repeater license with it! What a way to find out my license had been issued!

So, you might tell the readers that they better double check the name on their new license before they get the ID'er all changed. Hi, Hi.

Jeffrey Bishop W7CTX
Boise, Idaho

JUNE 13–2M DX?

This morning at 0850 CST monitoring local 146.94 direct here in Mexico City a W4 mobile in Okeechobee, Florida suddenly broke the squelch on my Standard 826 calling QRZ. I immediately answered and he correctly acknowledged my call (XE1WS), every bit as surprised as I was or more so. I caught his call sign also but promptly forgot it in the excitement of the moment before I had a chance to write it down. Within about 30 seconds conditions were out, and I am therefore pretty sure it was a meteor scatter contact. Distance from Mexico City to Okeechobee, Florida is about 1780 airline miles!

As you can imagine, I am very anxious to determine who I worked and perhaps if you can run a short note on this incident in the next 73, I may be able to find out. Since he copied my call he may just drop me a QSL, but who knows, even though XE's are super DX on 2 meters. Anything you can publish to help would be greatly appreciated.

Also, for your general information which you may want to publish, there is growing activity on 2 meter FM in Mexico with all the activity centered around Mexico City. Operating norms are about the same as in the U.S. Almost all activity is presently 94 direct but we will have our first open repeater operating in about 3 weeks on 16/76. Equipment is Standard RPT-1, tower height is 125 ft. located in the hills on the west edge of town overlooking all of Mexico City. Antennas are Hustler 6 dB-receive/Cush Craft stacked dipoles 6 dB omnitransit. Call sign XE1WS (my call) but the repeater is a joint project of the Assocation VHF de Mexico (our local repeater club). QTH is OK in the call book for XE1WS.

R.N. Green XE1WS ex W2GFO
Palmas 1460
Mexico 10, D.F.
Mexico

COUNTER STEP NO. 2

Now that Peter Stark has had his fine counter "Lily Gilded" in your last issue I have an idea that I incorporated when I built mine last summer and you get it almost for free.

I noticed that the LED readouts on digital calculators all had decimal points that could be moved at will with a switch. Looking at the specs for the Man-1 LED readout in my counter, I saw that pin six was the decimal point cathode which would light if grounded through a 220 ohm resistor.

The decimal point should light only with the kHz/Hz switch in the Hz position and with three digits to the right of the decimal point with the Hi/Lo switch in the Lo position, and with two digits to the right with the Hi/Lo switch in the Hi position.

Replace the SPST kHz/Hz with a DPDT. Ground the center of the added section through a 220 ohm ¼ watt resistor. From the circuit that is completed with the switch in the Hi position run a lead to the center of an additional section of the Hi/Lo switch which is now a Triple-pole DT instead of DPDT. The other terminals of the added switch section have leads to pin six of the center readout for "Lo" and the next readout to the right for Hi.

It is nice to have the decimal point show up without having to think about it each time, particularly in the right place!

If one wanted to be really chintzy one could arrange to have the decimal point on the leftmost readout serve as an over-range indicator instead of a separate LED.

Edson B. Snow W2UN
Rochester, New York

GOOD VIBES

Keep up the fine work on your magazine. It is tops as far as I can ascertain! I will continue to read it until it is no longer readable or I am no longer able to read! I will be going to the land of DX soon for about six months and as soon as I am allowed to I will send a change of address and also my call and operating frequencies/hours.

Bob Hughes
Alexandria, Louisiana

READ THAT METER

When in your January issue you announced that 73 was going Metric, I applauded your stand and then leaned back to see what developed. Now I was prepared to forget little things such as 6-32 screws and the like. However, an error such as appeared in your April issue (and by an Editorial Staff member at that) I find difficult to forgive. I am referring to W7DXX's article "2 Meter FM at 14,000 Feet," Shouldn't that be "2 Meter FM at 4267.2 Meters"?

Kenneth J. Koster WA7RYP/Ø
Bismarck, North Dakota

By golly, you're right... 4267.2 meter FM on 2 meters!

PAY TV – 1947 STYLE

Sooner or later everything turns up in the surplus market, and sooner or later somebody usually buys it at a bargain price.

I got a nostalgic twinge as I read Meshna's advertisement (as I always do) on page 138 of 73 for May. There it was – the whole bag of tricks in

(Continued on p. 96)

J. Houser K2EEE
Bill Noah III, W2JKI
23 Washington Street
Rensselaer NY 12144

NOVEL 160 M ANTENNA

You can have an antenna like this almost anywhere. Limited space means almost nothing. It can be fitted to accommodate the contour of just about any size or shape of building or lot. As a restricted-space antenna on 160 meters, it proved to be the answer to a maiden's prayer.

If you have a very noisy location, consider that an antenna of this type has probably the lowest noise factor of anything you could erect. Static discharges are really minimal. While lightning direct hits can ruin just about any equipment, the chances with an antenna of this type would be less than most conventional antennas if a small spark gap across each meter is provided.

This is a nominally *grounded* antenna – that is, one end is connected directly to ground – rather unconventional, but practical.

It is a random-length antenna. As long as you have *some* wire, somewhere, of reasonable length, it will radiate, and quite efficiently. The only drawback, if you can call it such, is that it takes two to tango – i.e., two guys to properly adjust it. But when properly adjusted, the swr should be around 1.1 at the tuned frequency, and not more than 1.5 when 25 kHz away either way (at 160) which covered the whole 160 meter band nicely without subsequent adjustments, if tuned for the center frequency of the band.

The coil at the feedline end is not grounded but the coax connector can be easily strapped right to a nearby pipe.

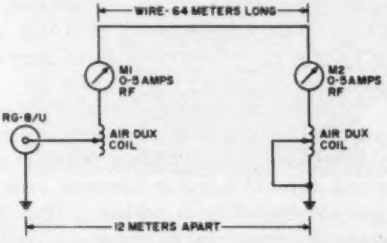


Fig. 1.

The antenna Bill W2JKI put up for 160 has 64 meters of wire. It is strung from the first tuner in the basement out through a basement window, up alongside the house (with standoffs), and around the side of the house (near the top) at roof level. From there it runs up at an angle to a tower, back down to a pole near the front of the house, and from this pole down the front side of the house (on standoffs) to a window in the front of the basement, through it, and down to the second tuner and grounded. (Whew!)

Note from the diagrams that two tuners and two meters are required. The meters actually should be a matched pair if possible, i.e., of same make and range. Two 0–5A rf meters were used, 2% accuracy.

The two tuners were identical Air Dux coils 6.35 cm in diameter, 14-gage wire, spaced, with 40 turns per coil. For 160 about half the turns were used. The coils could have been half the number of turns, actually. For any higher frequency bands, far less turns would be satisfactory, depending of course on the amount of wire between the two. The two coils are about 60 feet from each other (the length of the basement), so no inductive effect was noticed.

The grounds at each end were positive. In addition to making use of the water pipes, three 250 cm ground rods were driven at the feed end, and one at the grounded end. The water pipes all through the house acted as a counterpoise-ground.

The tuning is a matter of cut-and-try, tapping down from the zero-turns end of each coil one turn at a time (equally) until each meter reads the same as the other, at which point the antenna will be tuned and the 50Ω feed point from the RG8/U cable matched.

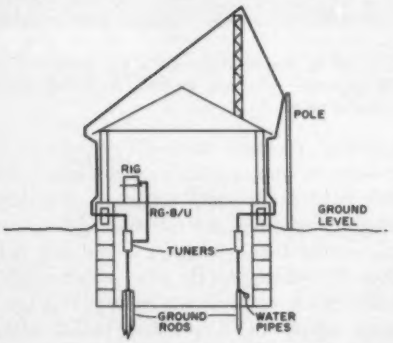
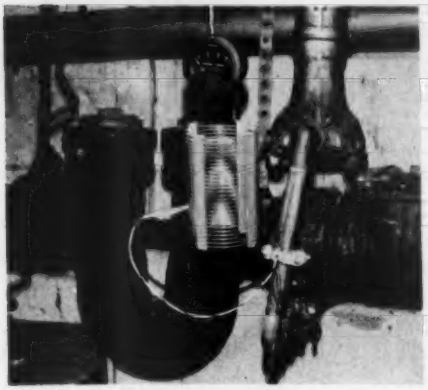


Fig. 2.



Note the interesting arrangement at the grounded end. Make sure of solid contacts to prevent backup of that high energy rf!

One very good reason why we know the antenna was more efficent than most on 160 was that for about equal power QSO's the S-meter readings were better on reception than the readings on the other ends. On transmission, better reports were received than other stations like distances away with comparable powers and different antennas. How you hear the other guy and how well he hears you is still the best criterion as to how efficient your antenna is.

The principle of operation of an antenna of this type seems rather obscure. It might be compared to a radiating transmission line, with equal current at each end, balanced.

The photographs show the coils at the feed end and at the grounded end. The plumbing is thrown in for background.

We know this antenna worked well on 160. Further evaluation of its merits will necessarily have to wait until many hams try something similar on 80, 40 and 20.

We would have only one caution – if you have children or pets around, be very careful as to where and how you run the wires out of and into the house or basement so as to avoid the possibility of contact as there is a respectable amount of rf present.

. . .W2JKI & K2EE

A BASIC SOLID-STATE SLOW SCAN TELEVISION MONITOR

Ralph E. Taggart WB8DQT
4515 Oakwood Drive
Okemos MI 48864

The first requirement for a newcomer to SSTV is to acquire a monitor. The basic goal behind the design of the unit described here was to develop a basic monitor with good performance while keeping the component count and circuit complexity to an absolute minimum. The resulting circuit uses a magnetically deflected cathode ray tube (CRT) for bright picture display and is relatively simple in concept and construction. The circuit was designed around readily available over-the-counter parts to mimimize procurement problems which often plague the home brew fanatic these days. If minimum cost is a factor, extensive substitution of surplus and bargain parts is possible and guide lines are provided following the circuit description. A well-stocked distributor should have virtually all of the components called for with the exception of the CRT which will probably have to be special-ordered. If the monitor is built in the modular form recommended, it is possible to experiment with new circuit ideas as they become available, thus gradually updating the circuit. As described, the

Front view of the slow scan monitor. The two operational controls are the on/off - brightness control on the lower left and the sync trigger control on the lower right. Immediately to the left of the CRT bezel is the manual vertical reset button and left of this is the LED tuning indicator.

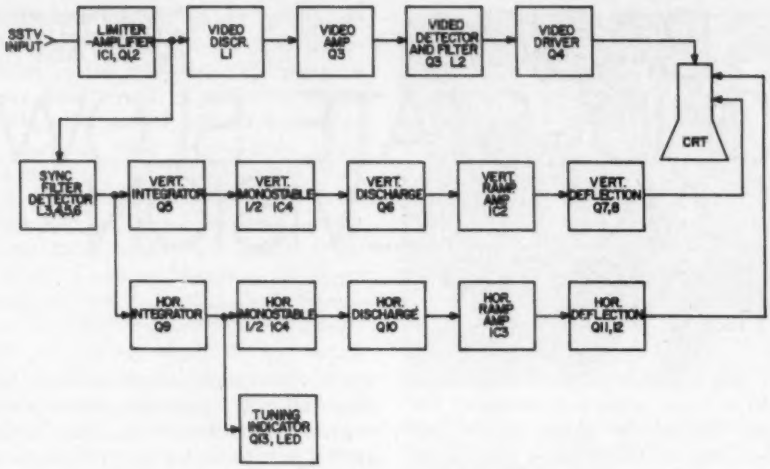


Fig. 1. Block diagram of the WB8DQT SSTV monitor.

circuit will recover excellent pictures under any but the worst conditions of noise or QRM.

Circuit Description

The SSTV picture is transmitted as an audio tone of varying frequency. Sync pulses to start each line and frame are sent as bursts of 1200 Hz while light intensity values between black and white are transmitted by varying the tone between 1500 Hz (black) to 2300 Hz (white). A monitor circuit must separate out the 1200 Hz sync pulses and use them to control the scanning of the monitor CRT and must also utilize the video frequency shift to bias off the CRT to provide brightness variations on the monitor screen. A block diagram of the monitor circuit elements is reproduced in Fig. 1 and will be referred to in the following description.

Since the picture information is transmitted as a tone of varying frequency, we want to remove all amplitude variations in the incoming signal caused by factors such as fading, variations in input level at the transmitter, changes in receiver gain controls, etc. IC1 functions as an audio frequency limiter to perform this function and is followed by a fixed gain audio amplifier (Q1 and Q2) to provide sufficient signal level to drive the other circuits. Video information is recovered by passing this signal through a 2300 Hz tuned circuit (L_1) which acts as a video discriminator. The black and white frequency limits will be used for the purpose of illustration but a linear response between black and white may be assumed in visualizing the reproduction of intermediate grey values. The output of the discriminator is a signal whose amplitude varies from a relatively high value for black (1500 Hz) to a relatively low value for white (2300 Hz). This amplitude "modulated" signal is fed to Q3 and is further amplified. Variable gain is incorporated in this stage for contrast control. The output of Q3 is detected, providing a relatively higher dc voltage during black portions of the picture and a low dc output when white is being transmitted. This varying dc level is used to drive a high voltage transistor, Q4, which is connected to vary the grid bias on the CRT. At the optimum setting of the contrast control, the relatively high dc output of the video detector will bias off the CRT during black portions of the picture, causing the CRT beam to be extinguished and producing a dark display on the screen. The low output of the detector during white portions of the picture has a minimal effect on the CRT bias, the beam is almost at full intensity, and a white display (actually bright yellow due to the type of phosphor required) results. A long

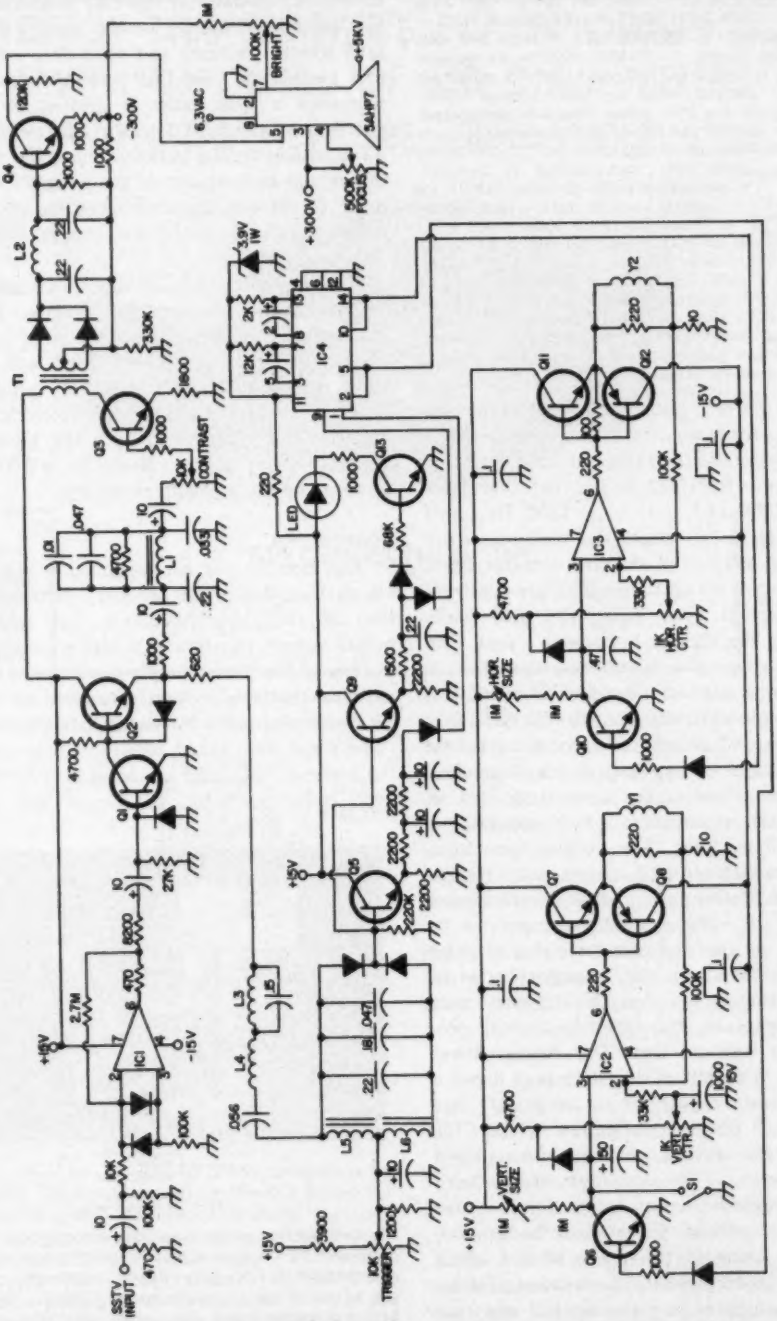


Fig. 2. Schematic of the WB8DQT SSTV monitor. See parts list on following page.

PARTS LIST

Q1,2,3,5,6,9,10,13 – HEP 55; Q4 – HEP 240; Q7,11 – HEP 245; Q8,12 – HEP 246; IC1,2,3 – HEP C6052P or C60536; IC4 – HEP 570; All unmarked diodes – 1N457, 1N914 or general purpose rectifiers; all resistors 1/2W; All capacitors in mF – decimal values are 100V tubular Mylar, electrolytics are 25V unless otherwise designated; contrast, vertical and horizonal size and center pots are 1/4W PC pots; all other pots are 1/2–2W units; Y1,2 – both coils incorporated in standard 70–90° TV deflection yoke (Stancor DY-21 or equiv.); S1 – manual vertical reset – pushbutton switch; T1 – Triad TY-27XT (500:500Ω CT); L1,4 – Triad EA-100 toroid (100 mH); L2 – Triad C-27X filter choke (0.7H); L3 – Triad EA-070 toroid (70 mH); L5,6 – Triad EA-020 toroid (20 mH); LED – Industrial Devices Inc. 2190LI-12V – other LED's may be used if resistor values are altered to accommodate their voltage and current ratings; front panel controls – brightness, trigger, LED, manual vertical reset.

persistence (P7) phosphor is used so that the video information may be viewed in its entirety despite the extended frame time.

Output from Q2 is also fed through a series filter (L3, L4) to a 1200 Hz tuned circuit (L5, L6) where the sync pulses are detected. Output of the sync detector drives Q5 which is set up to integrate the relatively long vertical sync pulse (30 ms) while rejecting the shorter horizontal pulses. The output of Q5 is a 30 ms dc pulse which is fed to one half of IC4 which is wired as a monostable multivibrator. The rectified vertical pulse, which may be noisy, distorted by multipath, or of incorrect length, depending upon the setup of the camera, is used to trigger the monostable which generates a clean 30 ms pulse. The output pulse from the monostable is used to turn on Q6 for the duration of the pulse and effectively shorts the 50 μF vertical discharge capacitor to ground. At the end of a vertical sync pulse Q6 goes "off" and the capacitor begins to charge through the 1 meg resistor and 1 meg size control in the collector circuit, producing a ramp voltage. This voltage drives IC2 which amplifies it and in turn drives a complimentary pair output stage (Q7 and Q8) which provides deflection to the CRT through the vertical windings of a standard TV yoke coil. The operation of the horizontal stages is similar except for the time constants involved. Q9 serves as the horizontal sync integrator driving ½ of IC4 which drives Q10 to generate the horizontal ramp voltage which is amplified by IC3 and used to drive the horizontal output stage consisting of Q11 and Q12 which in turn drives the horizontal windings of the CRT yoke assembly. Dc pulses from Q9 are also used to drive Q13 which functions as a solid-state switch and turns "on" an LED tuning indicator whenever a sync pulse is present in the passband of the sync detector. This provides a convenient tuning indicator since the sync pulses will only appear in the narrow "window" of the sync detector when the station SSB receiver is tuned for proper carrier insertion.

The suggested power supply cirçuit is straightforward and provides regulated plus and minus 15V outputs for the solid state circuits and plus and minus 300V, unregulated, for the CRT circuit. The CRT requires between 6 and 10 KV for acceleration voltage. This is provided by a HV module available from Robot Research which is powered by the low voltage supply.

Construction

The monitor can be assembled in almost any fashion that permits proper interconnection of the circuit elements, but certain points deserve mention. It is highly desirable to remote the power supply circuit from the monitor itself to prevent distortion of the CRT scanning beam by magnetic fields from

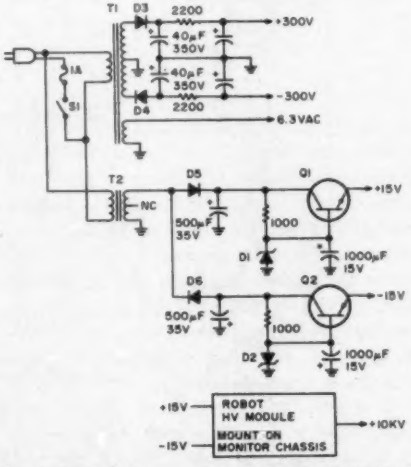


Fig. 3. Suggested power supply for WB8DQT SSTV monitor. T1 – Triad R-6A – 480 VCT 50 mA, 6.35V 2A; T2 – Stancor P8357 – 25V 2A; D1, 2 – 15V 1W zeners (HEP Z0418); D3-6 – 1000 PIV 1A (HEP 170); Q1 – HEP 247; Q2 – IR TR29.

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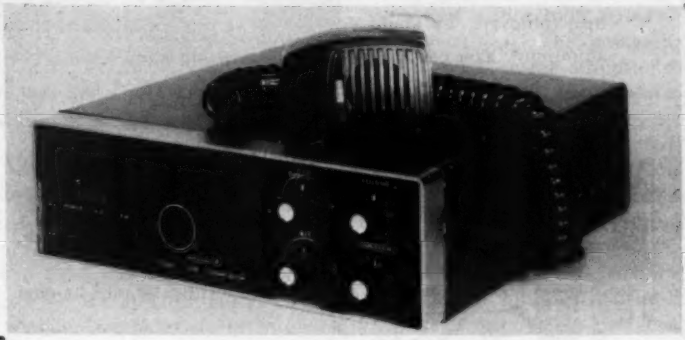

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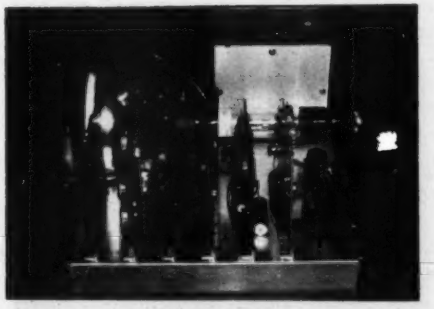
the power transformers. The power supply can be interconnected to the monitor via a multiconductor cable. In my own case I used a SPST switch on the brightness control to turn the supply on remotely using two additional conductors in the interconnecting cable. The HV assembly should be mounted directly on the monitor chassis.



Side view of the monitor with the cabinet removed. The small transformer located behind the circuit boards is the video filter choke (L2) with the contrast control next to it. The individual circuit board assemblies are mounted to the chassis using aluminum brackets. The CRT and deflection yoke assembly are mounted near the center of the chassis with the Robot Research HV module in the metal box on the far side.

In the case of my monitor I constructed the different circuit elements on discrete circuit boards. I would suggest the following breakdown:

Board 1: Limiter and input amplifier.
Board 2: Sync detector and vertical and horizontal integrators.
Board 3: Vertical deflection circuits.
Board 4: Horizontal deflection circuits.
Board 5: Video discriminator and video circuits. Sharp-eyed readers will note six boards in the monitor illustrated. This version incorporates an additional board for all the toroids and associated capacitors and although this works fine, fewer interconnections are required if the tuned circuits are placed on the other circuit boards.

The boards can be conventional pc types but this means quite a bit of work unless you want to mass produce monitors as part of a group project. Vector board can be used

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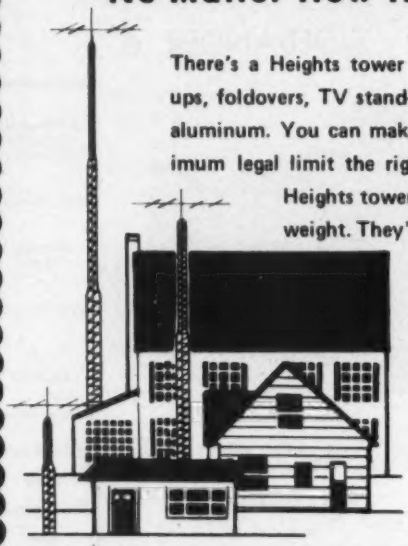

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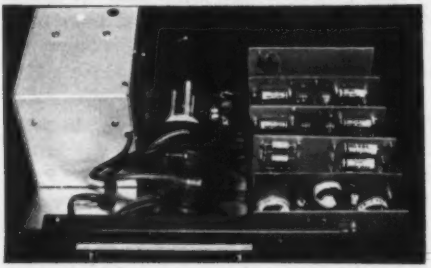
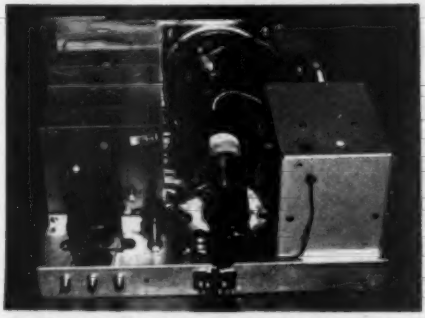


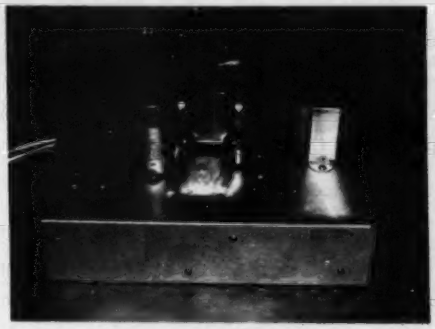
Oblique front view of the monitor showing the method used to mount components on the unclad PC stock.

but all those unused holes look kind of messy. In my own case I worked up a full scale layout on a piece of paper the same size as the final board, taped this template to a piece of glass board stock (without copper) and drilled holes for the small vector pins only where required for the layout. This makes a very neat arrangement which looks almost as good as a printed board when finished.

The brightness (plus on/off) and sync trigger controls are the ones which have to be mounted on the front panel. The manual vertical reset pushbutton switch and the LED indicator should also go on the front panel. The contrast control can be mounted on the chassis for easy access but need not be adjusted following initial setup. All other pots can be ¼W trimmers and are best located on their respective circuit boards



Rear view of the monitor. The HV module is on the right, the circuit boards, video filter choke (L2) and contrast control are on the left. The focus pot is mounted on the chassis just below and to the left of the CRT base.



The remote power supply for the monitor.

since they are usually not adjusted after initial setup of the monitor.

An LMB CO-1 cabinet makes an attractive package for the monitor, but you might wish to consider a cabinet styled to match existing gear in the shack. A suitable bezel for the CRT can be expensive and difficult to obtain. I solved this problem by using a 13 cm square piece of plexiglass backed up with a piece of black construction paper with an 8 cm square cutout to define the viewing area. A sheet of yellow acetate plastic may be placed between the CRT face and the rear of the front panel to mark out the bright blue flash characteristic of the P7 phosphor, permitting easier viewing of the persistent yellow video display.

Parts Substitutions

The single most expensive item is the 5AHP7A tube specified. This is a modern, electrostatically focused CRT with an aluminized phosphor which provides excellent performance in this application. As far as I know, this tube is not available on the surplus market. The 5FP7, a common surplus item, can be used with only two modifications. First of all the focus pot specified should be deleted and, secondly, a permanent magnet focus coil assembly such as the Quam "Focalizer" must be mounted on the CRT neck in back of the deflection coil assembly. These units were used on many models of early tube-type TV sets and the junkers in local TV service shops are your best (and cheapest) source.

Deflection coil values are not at all critical and virtually any deflection coil assembly can be used as long as it will physically fit the neck of the CRT.

Most of the transistors specified (Q1-6,9,10,13) are general purpose NPN types (2N718, 2N3391, etc.) so surplus bargains are fine. Be sure to test them first, however, if your source is suspect. Q4 is an NPN unit with a 300V rating – otherwise it is not critical. The complimentary pairs (NPN - PNP) in the output of the deflection stages can be any complimentary pair types rated at at least 30W. The NPN and PNP transistors in the power supply regulators are general purpose power types in TO-3 cases. They drop approximately 10V in the circuit shown and will get very hot unless properly heat-sinked.

The HEP ICs specified for IC1-3 are op-amps in 8 pin TO-5 or mini-DIP packages. 741 op-amps in either the TO-5 or mini-DIP packages can be substituted with no change in pin numbering. These ICs are readily available and quite cheap. 709 op-amps in the TO-5 package may also be used with no basing changes but these must be frequency compensated by the *addition* of a few more components. Figure 4 indicates what

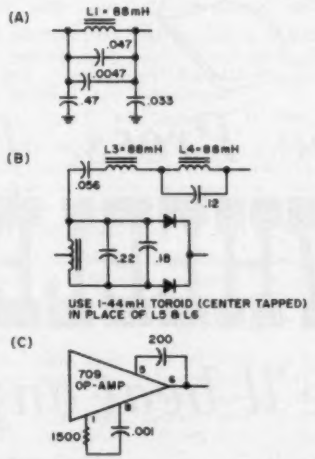


Fig. 4. Modifications of WB8DQT monitor when using surplus components. (A) Modifications of discriminator when 88 mH toroid is used for L1. (b) Sync circuit modifications for use of 88 and 44 mH toroids. (c) Additional components required for frequency compensation when 709 op amps are substituted for IC1, 2, and 3.

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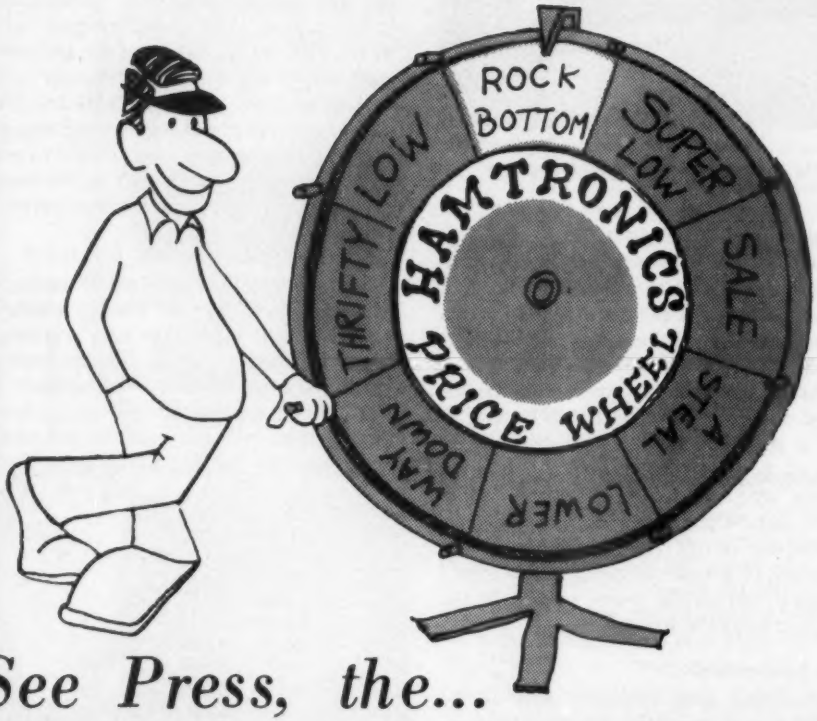

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View of the underside of the power supply chassis. The LV supply components are mounted on individual boards mounted on the side of the chassis in the upper part of the picture with the exception of the regulating transistors which are mounted on individual heat sinks on either end of the chassis.

changes must be made. IC4 is a Quad 2-input gate which can be replaced with a Motorola MC-824P.

The toroids specified are relatively inexpensive Triad types since the availability of surplus toroids becomes more variable as time goes by. Figure 4 also shows changes in the tuned circuits which can be mady to incorporate surplus 88 and 44 mH toroids if you have a source of supply.

You can save money by building a HV supply rather than using the module specified (see article by W9LUO in March '71 *QST* or various circuits in the SSTV Handbook by *73*) but being lazy can sometimes be a virtue.

Initial Setup and Adjustment

This monitor cannot adequately be set up using a tape you record off the air. It achieves its resistance to QRM by using high Q coils in the sync section and tuning accuracy is so important that the chances of your getting the correct tuning operating blind are minimal. A recording obtained from another slow scanner or the test tape which Robot Research sells for a very modest cost is required. The latter tape is ideal in that it contains a grey scale pattern which is ideal for setting up the contrast control.

Start by setting contrast, vertical and horizontal size, and vertical and horizontal centering controls to mid-scale. Turn on the monitor but keep the brightness control turned down. As the CRT warms up adjust the triggering control through its range as a slow scan signal is fed into the input. You should note the LED tuning indicator flickering in time with the horizontal sync pulses over at least part of the range of the control. The indicator will brighten momentarily during the vertical sync pulse due to the longer duty cycle of this pulse. Turn up the brightness until the trace is just visible and use the horizontal centering control to move it into the viewing area. The horizontal size control is used to expand the trace to fill the viewing area. You should be able to get horizontal triggering over much of the range of the triggering control. Adjust the trigger control to the point where the picture will begin to scan downward but not past the point where it will fail to reset when a vertical sync pulse arrives. If the picture scans upward or the trace jumps to the bottom of the screen when the reset button is pushed you must reverse the vertical deflection leads. All of the size and centering controls should be optimized for a square picture that just fills the viewing area. The brightness can now be set at a comfortable viewing level, usually half scale or just a little beyond, and the contrast control adjusted for optimum grey scale rendition. With proper adjustment of this control the beam will be completely extinguished in black areas of the picture, white areas will have maximum brightness, and there will be a smooth grey scale response with all bars of

Monitor display from a transmission by W9VZL/3 (now W4UMF) and recorded in 1967.

the grey scale pattern clearly resolved. You will find that there is comparatively little interaction between brightness and contrast, so the brightness control can be varied without shifting overall video response. Since the monitor employs triggered sweep circuits the trace will move off the screen if no signal is present.

Actual operation of the monitor in conjunction with the station receiver consists of tuning the receiver for maximum brightness of the flickering sync display of the LED. If the receiver is tuned this way the monitor will trigger properly and the grey scale reproduction will be identical to that obtained with closed circuit tapes. The LED will brighten with any audio signal that falls in the sync detector passband as the receiver is tuned, but video information, noise, splatter and other interference sources will produce a random brightening quite unlike the normal sync display. Even a very weak fading signal can be tuned by peaking the indicator at the top of the fade cycle thus assuring that the monitor will be locked on the signal whenever it rises out of the noise. This tuning indicator has made it possible for me to track SSTV signals from OSCAR 6 despite rather pronounced Doppler shifts on overhead passes, thus insuring optimum video display at all times.

Photograph of a single frame from a transmission by WA9UHV relayed via OSCAR 6. The monitor maintains a stable display despite a low signal/noise ratio. A tuning indicator such as the one incorporated in this monitor circuit is almost a necessity to accurately track satellite signals due to the pronounced Doppler shift on the downlink transmitter, particularly during overhead passes.

Typical off-the-air picture display of a transmission from W4UMF.

The monitor performs very well in the presence of noise as shown by a photoggraph of a signal from WA9UHV received via the OSCAR 6 link. Other photographs have been included to show monitor performance under both closed circuit and on-the-air conditions.

...WB8DQT

Editor's Note:

To aid those who might wish to consider building this circuit, the author is selling two circuit board packages:

(1) MB-1 Etched circuit board. This glass epoxy board measures approximately 20 x 25 cm and contains virtually all of the active circuitry exclusive of the power supply. The board is designed to accommodate standard parts so the use of junk box components is possible. A parts layout sheet for the circuit board is included with a complete set of instructions for assembly, checkout and use. $9.95.

(2) WMB-1 Wired and tested circuit board. This is a completely wired and tested version of the circuit board, complete with the data package. The large LED used as a receiver tuning indicator is also included. The only additional components required for use with this package include a power supply, cabinet, CRT, a standard TV deflection yoke assembly, two pots, two ½W resistors, a push-button switch, and some hookup wire. This package represents an easy way to work up a quality monitor with no critical building or adjustment. $99.95

The circuits board are available immediately. Approximately two weeks delivery time will be required for the wired and tested version. Include a money order or cashiers check for the amount of purchase, and send to Ralph E. Taggart WB8DQT, 4515 Oakwood Drive, Okemos MI 48864, phone 517-349-1928 (evenings).

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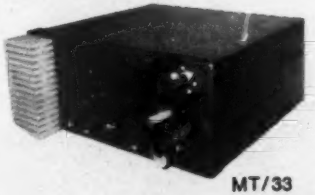

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LOW COST FREQUENCY COUNTER

A basic counter that . . .counts!

There are still a few hams who have not built a digital counter, due in some cases to misconceptions regarding the complexity of digital devices. The counter to be described is about as basic as a counter can get, is very inexpensive to build, and will count to above 30 MHz. The readout is in decimal form, using 7 segment incandescent Minitron display.

Devices used for the digital section of the counter are all SN7400 series. Data sheets on these integrated circuits are available from many of the suppliers, such as Poly Paks, Solid State Systems, etc. A careful reading of the data sheet will reveal there is nothing mysterious or even hard to understand about the operation of these digital counting ICs.

These IC devices are analogous to building blocks. All that has to be done is to connect these blocks correctly to build a counter. There is no interface problem between the blocks. There is a slight interface problem where the signal to be counted enters the first 7400 device. For instance, the 7490 will operate with either sine or square wave, but if the input of the 7490 is left open, it will drift up; the device will lock up and refuse to switch if the signal is coupled through a capacitor. Since capacitor coupling is often desired, a resistor can be connected from the input pin to ground to keep the input from drifting up and locking.

A resistor of several hundred ohms will correct the lock up condition and allow switching, but it was experimentally determined that a biasing network was a better solution. If the input is held at about 1.2V, a signal which swings symmetrically about this point will be counted with a minimum of wasted voltage swing. This does lower input resistance, but this is a minor inconvenience. It was thought that the IC might be confused about whether it was at a logical 1 (up) or 0 (down). This has not been a problem.

The disadvantage of feeding the IC chain directly is the low input impedance inherent in the method. A better method is described later in this report.

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Consider a 1 MHz sine wave, symmetric about a zero axis. Each cycle will have ½ T in the positive direction and ½ T in the negative direction, where T is the period and is 1/F. In exactly one second, 10^6 cycles will occur.

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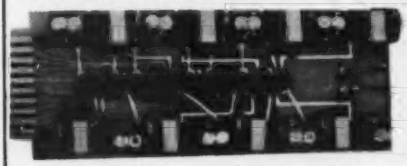

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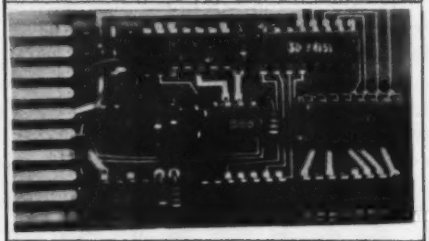

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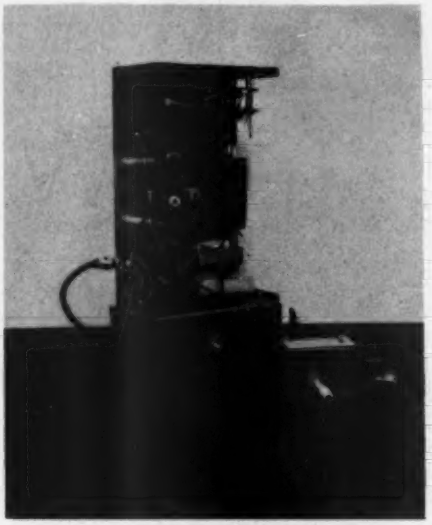

When built entirely of small sub-assemblies, a compact unit can be designed that will fit the most limited available space.

It is obvious that two things are required. The one second must be known to a high degree of accuracy and something must be available to detect (count) each of these micro-second intervals. The latter problem is simplified because each period is similar to the others and there is one positive excursion and one negative excursion during each period.

The 7490 will count this signal or any signal within its frequency range provided the negative part of the signal holds the 7490 input pin at less than .8V for at least 50 nano-seconds. The typical upper frequency limit of the 7490 is 18 MHz. Selection of the first 7490 will raise the frequency limit since some 7490's will switch faster than others.

Counter

A highly accurate timing signal is obtained by dividing down a 1 MHz signal from a frequency standard. The clock (Fig. 1) begins with a crystal oscillator which uses two cross-connected gates as active elements. This signal is divided to whatever frequency is desired. The frequency is selected by a switch which feeds the gating circuit (Fig.

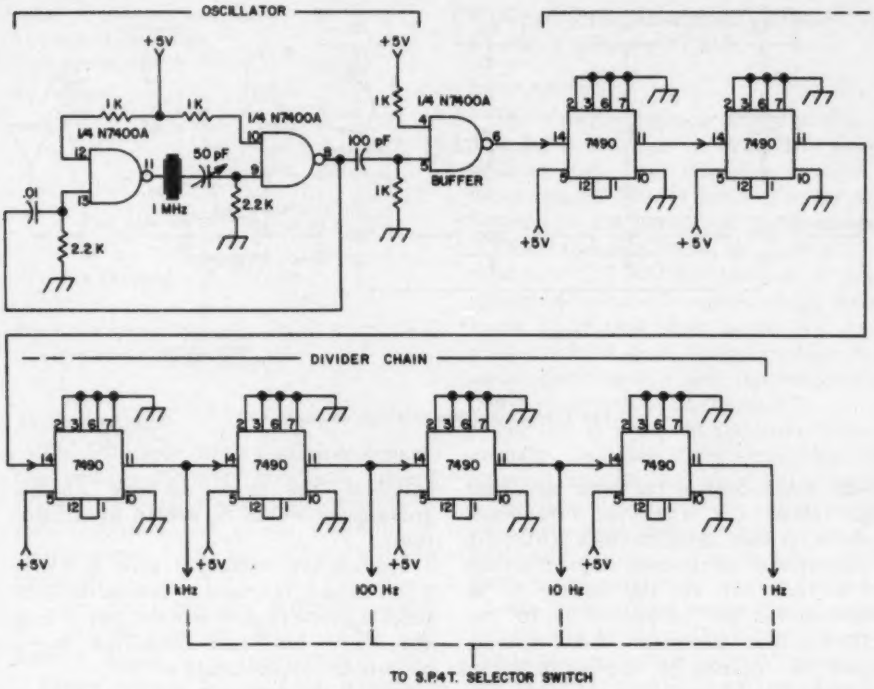

Fig. 1. The clock generates an accurate timing signal of 1 second, .1 second, .01 second or .001 second.

4). The signal coming from either of the clock outputs is a square wave, having an up or positive time of ½(1/F). (This assumes symmetric division, which is not necessary but is easier to understand.) This square wave goes up to the 7493 which counts to 16, overflows, and counts to 16, over and over. *The time this IC remains in any one count is 2(½)(1/F).*

When a count of 15 is reached a NAND gate detects the state and switches pins 2 and 3 of the first 7490 to ground enabling the 7490 to begin counting. The following 7490's are set up to count at this time and so the count chain (Fig. 2) operates. When the 7493 leaves count 15, the NAND gate switches pins 2 and 3 of the first 7490 high and the count stops.

Since the four displayed decades have not reached a reset pulse and no pulses are coming in, the display stays up. The 7493 is still counting, having started over after 15 and when a count of 14 is reached the 3 other NAND gates reset the 4 displayed decades. At 15, the cycle repeats.

Since 1 MHz is a 7 digit number, seven 7490's, seven 7447 decoder/drivers, and seven readouts would be required to count and display all 7 digits. The last 7490 in the

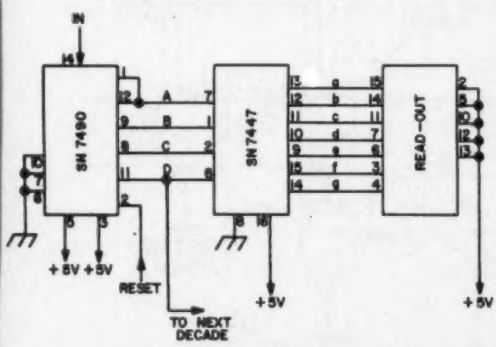

Fig. 2. This is the basic counting unit. It counts, decodes, and displays one digit. Four are required for 4 digit readout.

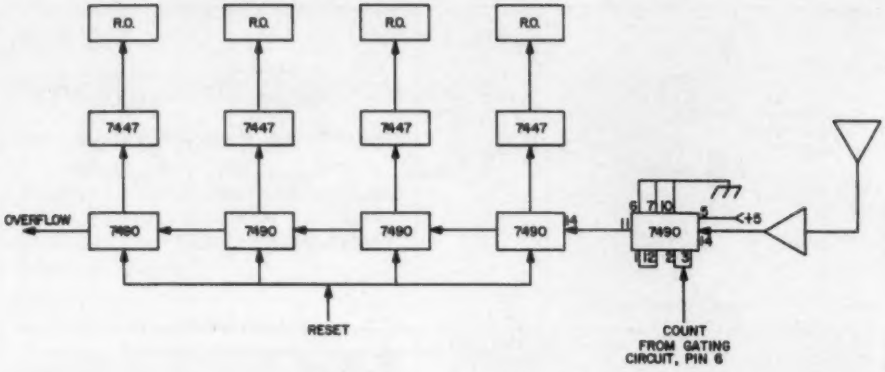

Fig. 3. Block diagram of 4 digit counter.

chain would contain the most significant digit (MSD), a 1. The input 7490 would contain the least significant digit (LSD), a 0.

However, if the counting period is divided by a factor of 10, the number to be displayed will also be divided by 10. The LSD has been eliminated, and 6 decades would be required to display all cycles counted.

In the same manner, if the count period is (1/1000) second, number of cycles will also be (1/1000) Frequency and the 4 digits displayed will be the most significant digits. Also, if only 4 digits are displayed and count time is 1 second and signal counted is 1 MHz, the counter will overflow and the 4 digits displayed will be the least significant.

By combining these operations, 4 digits can read out each digit of any signal within the range of the counter. Four digit readout (Fig. 3) appears to be a good compromise between cost and ease of operation. If the LSD is never desired, it is not necessary to provide a decoder/driver or readout for that digit. This saves the cost of the parts eliminated, and has the added advantage of increasing the upper frequency limit of the counter, since switching speed is partly a function of load on the IC.

For fast gate times the display appears to stand still, and will appear to 'track' a vfo. At the slowest gate time, the cycle takes 16 seconds. Since the primary use of the counter will be for MHz signals and resolution to the nearest kHz is usually sufficient, this is no problem. Another arrangement would be desired by a piano tuner.

The counter requires a good 4.75V to 5.25V supply. It is hard to damage the 7400 series if overvoltage is avoided, but at least one 7490 has been destroyed by a momentary supply voltage of 7V.

The supply described does a very good job (Fig. 5).

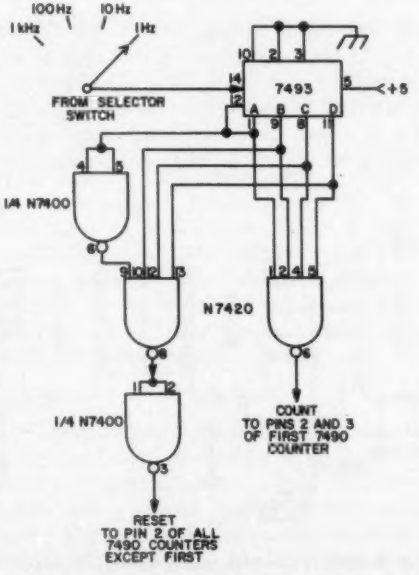

Fig. 4. Gating circuit controls count, reset, and display.

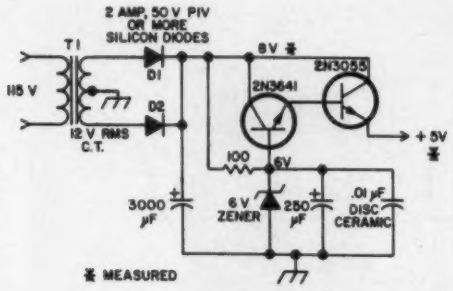

Fig. 5. 5V supply. This supply feeds all IC devices plus incandescent readouts.

5V Power Supply

The 5V supply uses a Darlington connected emitter follower. Maximum current drain of the counter was calculated for worst case conditions and it was found to be approximately 1.3A. The 2N3055 will pass this easily.

Zero output resistance is desired, so that V_O will be constant with varying load current. Actual R_O is approximately .04Ω.

Output voltage will be Zener referenced voltage minus two base emitter drops. Zener was chosen to be 6V, 1W. Zener current= (20-i_b)mA. Zener dissipation will not exceed 6 (.02)W, which gives a good safety margin.

This is a reasonably small percentage of 20 mA, the maximum Zener current. Both transistors are operating well within power, voltage and current limits. Unregulated voltage comes from a center tapped full wave rectifier. The capacitive filter gives 8V from a 6.3V rms transformer secondary. The 5V supply is shown in Fig. 5.

Input Amplifier

The input amplifier is shown in Fig. 6. The MFE 3007 is a MOSFET having relatively high input resistance. It drives a direct coupled 2N3641 follower which gives power gain and impedance transformation.

From the data sheet, R_L=2.5 KΩ. A resistor of 2.7 KΩ was selected. If drain current is chosen to be approximately 5 mA, about 13.5V will drop across R_L. It is desired to have about the same voltage drop across the transistor and this indicates a power supply voltage of at least 27V.

The bias network was determined experimentally, working from approximations obtained from the data sheet. The MOSFET is operating somewhat above voltage ratings on signal swings. Drain voltage maximum is 25V, while supply voltage is 35V, so bias was adjusted carefully to keep the device out of the high voltage region for extended periods. No ill effects have been observed due to the over-voltage. Output resistance of the MOSFET is taken to be approximately equal to the drain load resistor.

Output resistance of the emitter follower is about 50Ω. The 2N3641 is within all tolerances.

The resistor diode network at the output of the 2N3641 sets input conditions for the first 7490. The diodes conduct when signal input exceeds back bias plus the forward silicon junction drop. This prevents burnout of the 7490 which otherwise might occur.

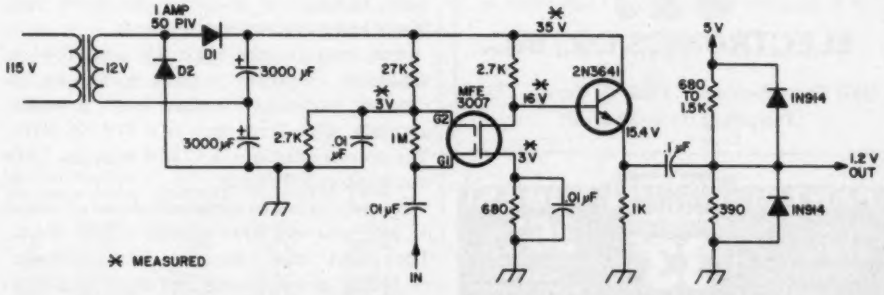

Fig. 6. Input circuit. Signal to be counted comes first to this circuit, where it is amplified, clipped, and fed to input of first 7490.

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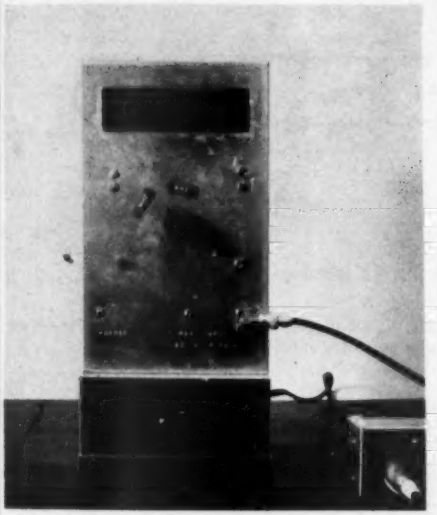

The main 5V power supply is mounted in the box that serves as the base for the unit. The input amplifier board and its power supply are mounted above that and all other circuitry leads up towards the read-outs at the top.

The input amplifier power supply is a common voltage doubler. Ripple is about .1V.

The original model which was built from the schematics in this article will count reliably to above 37 MHz. The crystal oscillator can be zero beat to WWV to get a highly accurate timing signal. Accuracy of displayed count, of course, is directly related to accuracy of the clock. For all known frequencies measured, counter error has not been visible, that is, the undisplayed digit contained whatever error existed.

For instance, the color TV chrominance subcarrier frequency is phase locked to the network frequency standard which is highly accurate. This frequency is 3.579545 MHz. The counter displays 3.57954 with the LSD not displayed, as usual.

A counter is one of the most useful pieces of gear you can have around a ham shack. The total cost for the basic counter excluding power supply and input amplifier was $33, and at this price there's hardly an excuse not to have one.

. . .Harper

Doug Pongrance WA3JBN
316 Donnell Road
Lower Burrell, PA 15068

VOM DESIGN

Convert that spare meter into a useful test instrument.

Many hams don't have a VOM in the shack and probably have run into more than one instance where they could use one. Well, here's how to get one for a fairly cheap price and learn something too.

The most expensive part of a VOM (if bought new) is the meter movement. If one is available in the junk box, good, but the next best place would be the ham fest. What to look for is the most sensitive (lowest ma at full scale) milli-or micro-amp meter. A 500 μa will do very nicely, but anything up to about 10 ma will do.

After obtaining a meter, measure its internal resistance using the resistance scale of a friends VOM.

For voltage measurement, resistors are wired in series with the meter to obtain different voltage scales. Decide what voltage scales you would like and see Fig. 1 for computing series resistor values. It is shown using 1, 5, 10, 50, 100 and 500 volt scales. Notice that none of the series resistors are standard values, but two or more resistors could be wired in series to obtain the proper value. To enable the meter to measure ac in addition to dc a rectifier and capacitor must also be wired into the circuit. Fig. 2 shows the ac - dc volt meter.

Desired Voltage Scale	Current Rating of Meter in Amps	Necessary Resistance	Internal Resistance of Meter	Series Resistor
1	.0005	2000Ω	150Ω	1850
5	.0005	10K	150Ω	9850
10	.0005	20K	150Ω	19850
50	.0005	100K	150Ω	99850
100	.0005	200K	150Ω	199850
500	.0005	1 meg.	150Ω	999850

Fig. 1. Table of resistor values for VOM.

For the addition of current scales different resistors must be wired in parallel with the meter. For a scale two times that of the meter, a resistor, equal to the meter's internal resistance, is wired in parallel so that ½ of the current goes through the meter and ½ through the resistor. For a scale three times that of the meter two resistors are wired across the meter so that 1/3 of the current goes through the meter and 2/3 through the resistors. The number of parallel resistors that are equal to the internal resistance is found in the following formula (A+B) - 1 where A equals the desired current scale in ma and B equals the full scale current reading of the meter. The parallel resistors for any one scale can be combined into one by using Ohms law for parallel resistance: Example:

I want 500 μa, 1 ma, 10 ma, and 010 ma current scales using a 500 μa 150 Ω meter. For the 500 μa scale no resistor is needed. For the 1 ma scale one 150 Ω resistor is used. For the 10 ma scale 19-150 Ω resistors are used in parallel which is equal to about 7.9 Ω. Two 16 Ω resistors in parallel could be used. For

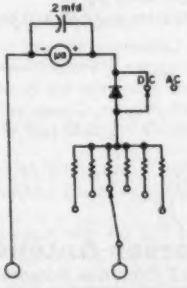

Fig. 2. Ac-dc voltmeter.

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the 100 ma scale 199-150 Ω resistors are needed, equal to about .85 Ω. Just use two .43 Ω resistors in series.

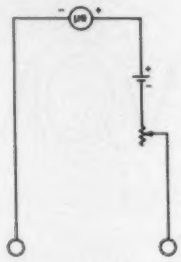

Fig. 3. Basic circuit for ohm-meter.

The next step is ohms scale. Fig. 3 shows the basic circuit for an ohm-meter. Calibration of the ohms scale will have to be found experimentally. Different values of resistors should be tested in the circuit to obtain approximate calibration. In my circuit using a 500 μa 150 Ω meter indicated about 100K at little deflection of the meter and about 1K at mid-scale.

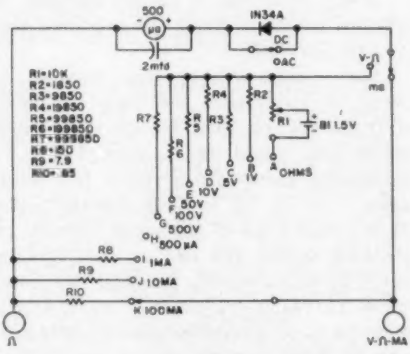

Fig. 4. Circuit for combined VOM with a 500 μa 150Ω meter.

Fig. 4 is the circuit for the combined volt-ohm-milliampmeter using a 500 μa 150 Ω meter. Five or ten % resistors can be used but 1% are better if they are available at a low price.

The VOM I built cost me about two dollars and works fine.

. . .WA3JBN

Clifford Klinert WB6BIH
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National City CA 92050

SIMPLE QRP TRANSMITTER

This article will describe a two transistor transmitter that is not difficult to build, and can supply up to one watt rf output for the QRP or portable sportsmen. The transistors are not excessively priced and are very reliable even though operated beyond their ratings. The use of an unusual type of keying provides chirpless keying with a negligible backwave. The transmitter operates from a 12 volt source making a car battery or lantern batteries ideal for portable use. With this configuration, tuning is not critical and the transmitter is completely stable. The output tank circuit is relatively inefficient but provides good selectivity and is simple to tune and construct.

The Circuit

The schematic is shown in Fig. 1. This is just about as simple as a transmitter can be made to provide this type of performance. Q1 is the oscillator transistor. This oscillator circuit was designed by trial and error for simplicity and reliability. Keying, however, is very poor. If the final, Q2, is only keyed by turning the B+ on and off, the signal from the oscillator will feed through the transistor. This is an inevitable result of the basic characteristics of the transistor, and the rf path must be broken. The obvious way to do this is to key the signal from L1 to Q2. This completely eliminates the backwave and chirp problem.

The final stage is operated as a straight through amplifier. A resistor and bypass conductor might be added to the emitter to bias it farther into class C, but this would of course add extra components and reduce the simplicity.

The tank coil, L3, is link coupled to the antenna and Q2 by fixed link coupling. The small number of turns on L2 and L4 allow L3 to have a higher impedance for better selectivity. The antenna and transistor have a lower impedance that is the source of many of the matching and tuning problems in transistor transmitters.

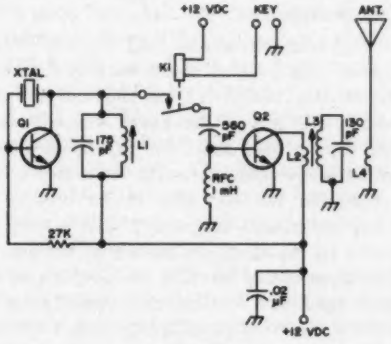

Fig. 1. Schematic

XTAL	7 MHz fundamental
Q1	40080
Q2	40081
L1	20 turns No. 28 on ¼" dia. slug tuned form
L2, L4	5 turns No. 24 on L3
L3	28 turns No. 28 on ¼" dia. slug tuned form
K1	sensitive spst relay for 12V (see text)

Comments:

The resistor is 1/2 watt carbon, capacitors can be disc ceramic or mica, and heat sinks must be used on both Q1 and Q2.

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Construction

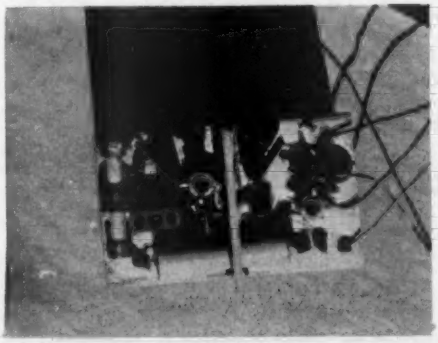
The transmitter was built on 1/8" thick double clad printed circuit board. Figure 2 shows the layout of the bottom of the board. The top of the board was left with the copper clad sheet on except in places where leads come through. This allows the copper on the top side to be used as a common ground connection that is easy to solder to anywhere on the top of the board. This double clad board is also very mechanically rigid and leaving the copper on provides a means of structural connections by soldering.

The only unusual component is the relay, K1. This is a sensitive reed relay that is ideal for this purpose. The current for the coil is only a few percent of the total current that the transmitter draws. Other types are available in the catalogs, and the only major requirements are compatible size, low coil current, and fast switching. Good quality contacts are also necessary to minimize clicks.

The board can be processed by the methods outlined in any good printed circuit board kit, or the builder may wish to use his own methods. An easy method is to use paint as the resist and obtain Ferric Chloride from a chemical supply house for the etchant. The paint can be applied with a small brush where the conductor is to remain. The parts to be used should be kept handy to check for size and position. Clean the copper before applying the resist by rubbing with steel wool. Keep the steel wool away from any electrical equipment. During etching, the etchant and board are placed in a shallow pan or tray. The solution must be kept warm to hasten the chemical reaction. This can be done with a heat lamp or very carefully on a stove. A beginner should start with a good kit and develop his own methods after a little experience.

The capacitors are soldered directly on to the coils and are placed wherever the shortest leads will result. Components are soldered in with little trouble, and placement and layout are not critical.

The transistors must have heat sinks because of the power that must be dissipated. Since there is little room for the commercial type heat sinks with radial fins, homebrew heat sinks had to be made. They can be simply bent from copper as seen in the pictures. Use a copper that is stiff enough to retain a good grip on the transistor case. Silicon grease could be used to provide a good thermal contact, but this has not been necessary. If the transmitter is to be used in dark surroundings (inside a cabinet) the heat sinks can be painted black



WB6BIH QRP transmitter.

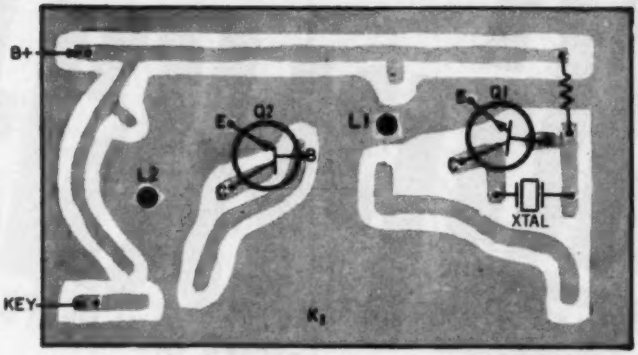


Fig. 2. Printed circuit board. Layout is not critical, this is merely a suggestion.

to increase heat radiation. If they are in the sun, they will absorb the heat, of course.

The construction of this unit is not complete as shown in the pictures. Sides and ends will be added and the unit will be installed in a cabinet with batteries for portable operation. I'm sure that each builder has different ideas of what he wants to build.

Results

The tests conducted on the final version showed tuneup to be non-critical on the oscillator. Oscillation will result with the slug of L1 in almost any position, but there is a point that will produce maximum stability. Adjust the slug of L1 while keying the final to check the loading effects of the final on oscillator stability. When the oscillator is oscillating the oscillator current will be considerably smaller than the non-oscillating condition. The oscillator can be tuned for a dip in collector current, but it will be necessary to detune from the dip to provide optimum stability. There is plenty of output from the oscillator to drive the final. The amount of drive to the final can be estimated by the amount of final collector current. Tune for maximum final collector current with good stability. The tuning of the final tank coil should produce a sharp peak when tuned through resonance. The link coupling was designed experimentally for optimum power transfer to a 50Ω load. Other final tank circuits provided more output but this circuit was easiest to tune and provided good selectivity against harmonics.

While tuning avoid prolonged key down periods because the transistors can become overheated in a few minutes. In a test, the input to the final was about three watts with output about one watt. This means that the transistor must dissipate the remaining two watts into the air, which is the maximum power dissipation rating of this transistor with a good heat sink. The use of CW allows the transistor to cool during key up periods but the transistor will still run quite warm.

A listen to the keying shows it to be quite sharp and free from chirp. A look at the scope pattern confirms this and the keying tends to be "clicky." This has not been a serious problem, however, and the simplicity of design and freedom from chirp makes it an acceptable compromise.

This transmitter will make an amusing weekend project for the builder with average experience, and QRP is an increasingly popular sport. Forty meter CW is very popular with a frequency of 7040 kHz, most popular for QRP use. This is a portion of our hobby with unlimited challenge. Contacts of thousands of miles have been established with much less than a watt, and one million miles per watt can be achieved with microwatt transmitters over short distances. Anyone can buy a kilowatt and work the world, but doing it with milliwatts is a personal achievement that can provide real satisfaction.

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THE NUMBERS GAME: DISTRIBUTION OF DXCC HOLDERS

When I received DXCC Certificate No. 12,189 on July 22, 1971, several questions occurred to me concerning the history of this award, how many DXCC members are in each of the 10 U.S. call districts, how many certificates have been awarded to amateurs in various foreign countries, how many countries does the "average" DXCC-holder have credited, and so forth. Then with the arrival of the December QST it became apparent that I could get the answers to some of these questions if I were willing to devote some time (and eyestrain) to counting the calls in various categories of the Annual DXCC List printed on pages 95–100 of that issue. True, the annual list contains just slightly under 20% of the total number of certificates awarded, but it is felt that the sampling is sufficiently large to at least indicate current trends.

Before commenting on the results of my curiosity, let me hasten to make the following disclaimers:

1. No guarantee is made as to the accuracy of any of the numbers presented. Counting and addition errors are certain to have been committed. Each column and page was totalled individually so the errors made should not be too gross (say less than 10 calls), but certainly small errors do exist, and possibly some of greater magnitude. The reader is invited to check any of the categories he is interested in, or to extract data for other groupings.
2. No conclusions are intended or implied from the data; particularly no *valid* con-

Table I
Number of DXCC Members by Number of Countries Confirmed (in Increments of 25 Countries and 50 Countries).

NO. COUNTRIES CONFIRMED	NO. DXCC HOLDERS	NO. DXCC HOLDERS
100–125	1,062	1,396
126–150	334	
151–175	297	562
176–200	265	
201–225	277	464
226–250	187	
251–275	215	450
276–300	235	
301–325	277	589
326–350	312	
TOTALS	3,461	3,461

Table II
The number of DXCC-holders in each continental United States call district and also the number of 2-letter call members.

U.S. CALL DISTRICT	NO. DXCC MEMBERS	PERCENT OF U.S. TOTAL
2	340	15.8
4	300	13.9
6	278	12.9
9	240	11.1
8	201	9.3
3	187	8.7
1	182	8.4
5	168	7.8
10	163	7.5
7	99	4.6
TOTAL U.S. MEMBERS	2,158	100.0
NO. 2-LETTER CALL MEMBERS	332	15.4
MEDIAN NUMBER OF CONFIRMED COUNTRIES OF DXCC MEMBERS—180		

Table III
Number of DXCC Members in Six Foreign Countries

COUNTRY	NO. DXCC MEMBERS	PERCENT OF TOTAL
Germany	222	6.4
Canada	121	3.5
Japan	114	3.3
U.S.S.R.	76	2.2
England	62	1.8
Brazil	49	1.4
TOTALS	644	18.6

clusions are possible as to the "best" or "most active" DX area. The number of DXCC certificate holders in any given area may be one "yardstick" to be used in settling this hotly debated question, but obviously many, many other factors would have to be considered, among them the distribution of the entire amateur population, the average age of DX amateurs in the localities in question (retirees have more time for DXing), geographic, political, and language barriers, legal restrictions on power in some countries, time zone disparities, economic affluence, etc., etc., etc., ad infinitum.

3. Time did not permit counting DXCC totals for every country (approximately 12–15 hours were spent at this task at odd moments). Hence, some countries with a significant number of DXCC-holders are not listed in the results.

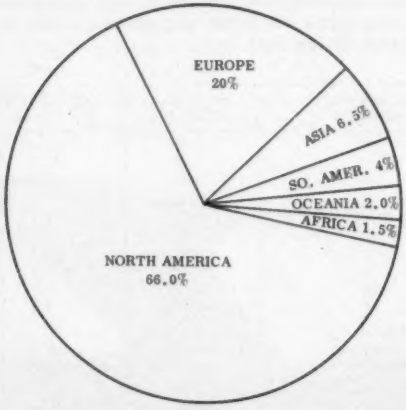

Fig. 1. In pie-chart form the approximate percentages of DXCC members by continental area.

Now on to the results. The first part of the job was to count the total number of calls listed in the general listing on pages 95–98 (mixed CW and phone – sorry, no results for phone-only listing). My count was 3,461. Next, I determined that the median point (1,730) fell in the grouping of 180 countries confirmed. Therefore, half of the DXCC members have less than this number of countries, and half have more. Since the columns on each page were counted individually, it was relatively simple to arrive at the number of DXCC members by numbers of countries confirmed. Table I shows these results in increments of 25 countries and 50 countries. The right-hand column of this table provided my first surprise result. As expected, the number of members decreases in a rather normal progression as you read down this column, until the last entry, where you find that 589 DXers have more than 325 countries credited, a sub-group exceeded only by the sub-group of members who have 100–150 countries confirmed.

. . .WA9VGS

Editor's Note:

Distribution of Licenses

According to the Callbook the distribution of amateur licenses falls about in this proportion:

Call District	Percentage
1	7.4%
2	12.5%
3	7.5%
4	13.4%
5	9.4%
6	14.2%
7	7.0%
8	10.2%
9	9.4%
Ø	9.0%

Thus there would seem to be some slight advantage to operating from certain parts of the country, if we assume that approximately the same number of amateurs will be devoted to DXing in all parts of the country. The number of DXCC winners is higher than the overall percentage of amateurs in the W2-W9-W4 areas, while it is less in the W7-WØ-W5 areas.

SOLID STATE EXCITER FOR 450MHz

Bill Hoisington K1CLL
Far Over Farm
Peterborough NH 03458

Working at 450 is not difficult if you know the techniques . . .

The UHF bands of 432 and 1296 MHz appear due for a large change and advance from now on as concerns portability, size, and usage. The availability of plastic transistors that work up in the 1296 MHz region, tenth watt resistors, small coils, crystals, and terminals, make construction of complete crystal controlled exciters possible in a 5 x 10 cm minibox with room left over for two 9V batteries!

This concerns such a unit, using doubling in all the multiplier stages. A comparison is also made with a similar unit which used tripling instead of doubling. Be sure to check on the final results as outlined later here. It may save you lots of time on such units.

Tools and Accessories

For the construction of a crystal exciter of this small size, there are certain things you should collect before you start. Without them you will lose time improvising and will not have such a compact unit.

A good, small iron. For some reason or other, the American Beauty iron people have been able to make an iron that you can leave on all day for years and years without having it burn out. I don't know how they do it, but some day I hope to visit them and find out. Just a hint: I have a 250 watter for large work, and a little one for small work such as 80–90% of the soldering done on this exciter. You have to have small solder too, of course. Keep a stock of small copper tips on hand and several files to shape the tips as needed. You'll see why when you tackle the small terminals.

Other small tools. If I may make some suggestions – two pair of tweezers, one flat, one pointed; the smallest sidecutters and needlenosed pliers you can get; a steel scriber; a set of No. 60 to 80 drills, with maybe some extra ones around No. 75 and 76; "coffee stirrers," which are just flat pieces of wood 7 mm wide by 10 cm long by 2 mm thick, with a pointed lump of wax (high-Q high temperature coil wax, that is) on the end for holding windings on the coils (use it like cement); several solid insulating rods of lucite and/or bakelite, 3 and 6 mm for filing into insulated screwdriver blades and insulated picks; small 10¢ screwdrivers that you file down for scraping around pins, on copper, etc.; emery cloth and crocus cloth for polishing brass plate capacitor surfaces; Exacto knife for cutting holes in fiberglass sheet; dentists' tin shears for cutting small brass or copper pieces; a jeweller's saw and plenty of blades, umpteen teeth to the inch; and all the rest of the usual tools you may have around.

Another handy tool is a coffee-stick with a 3 mm square 1000 pF bypass capacitor cemented on the end with 3 mm leads. This is the last word for testing

working bypass capacitors. Take any bypassed terminal or brass plate used for bypassing and connect this test capacitor across it, just by pressure. You don't have to solder it. Do it with all power on and watch the rf power output meter. If it makes any difference when you add it to the existing bypass, that bypass is not right. Remember, it isn't only the *amount* of pF at 432 MHz, it is also the length of the leads, if any, and the shape and position of the components being bypassed.

Components, Including Terminals

Resistors are easy, but you've got to put in a stock of 1/8th or 1/10th watters if you want to do the best job on small units like this exciter. Not all of the HEP56 transistors are exactly alike, so you may have to trim up the emitter resistors in the final tests. Best to have some of each of the following, in ohms: 22, 33, 47, 100, 220, 330, 470, and in thousand ohms, 1, 2.2, 3.3, and 4.7. I haven't used anything above 4.7K in this unit so that should about do it for resistors.

Most of the capacitors are easy, but you should have a good stock of the small high K ceramic bypass capacitors like .001 or .005. These should be the real small ones, say 3 cm square. I also use a lot of the small dippped mica silvered type DM capacitors for coupling, in values of 1, 3, 5, 10, 15, and 30 pF. They seem to do the job very well for VHF/UHF. Some multiplier stages like to have a variable coupling capacitor, and then you should use a small circular, or mica, trimmer. So far, in the UHF region, the mica compression trimmers seem the best for tuning; they are thin, long and narrow, and do a good job. It is easy to tell which is maximum and which is minimum, unlike some rotary ceramics. Arco makes excellent trimmers that are good for UHF, but please, why not use nylon tuning screws? Values in pF of 1 to 12, and 2 to 25, are good.

Winding wire should be on hand, and phenolic forms of 3, 5 and 7 cm OD Wire sizes can be 22, 24, 28, 30, and 34, looking at the spools I use here. Double silk covered is best.

Fig. 2. Jeweller's drill chuck, holding end.

A good crystal holder is needed, too. I'm still using a monster crystal 2 cm long simply because it's here, but expect to go down a lot smaller in crystal size soon.

Various kinds of insulation materials are useful, such as small strips of linen-base bakelite 2 or 3 mm thick for terminal strip pin mounting, putting between the coils and the copper-clad baseboard, etc.

Terminals. Here's a really sticky one. I spent several hours on this item alone and did succeed in making an improvement. Instead of making up small individual little planks with three pins each, I made up the terminal strips as in Figs. 1A and 1B. It worked out excellently, and from now on that's it for me. Notice in Fig. 7 how everything goes together on those pins, three for each stage. I cemented the strip down, but for greater mechanical strength you can use 0-80 or 1-70 bolts if you wish,

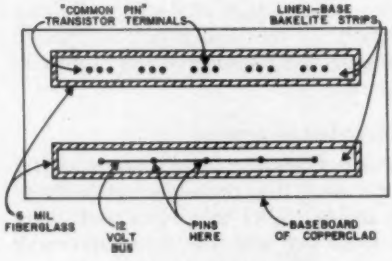

Fig. 1A. Terminal pin layout.

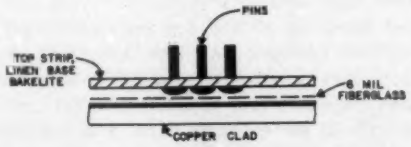

Fig. 1B.

which can be obtained from the better hobby stores. Also, note the 6 mil fiberglass under the strip to avoid shorting the pin terminals to ground. The terminals are just plain old common pins of nickel plated brass. I found some which are called "bank pins" which are really tiny. Drill the holes in the various terminal strips with a No. 76 drill. I use an old standard Black and Decker ¼ in. drill, in the less-than-$10 drill stand, a variac to slow it down, and a jeweller's chuck. The jaws of this chuck appear as shown in Fig. 2. You cannot, repeat *cannot*, use the cast, polished,

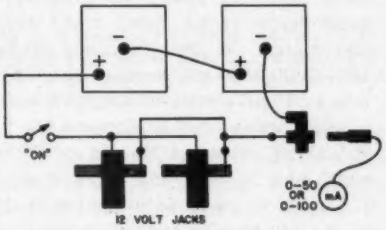

Fig. 3. Test battery detail.

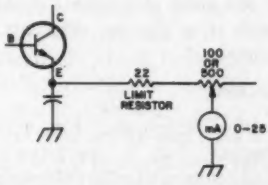

Fig. 4. Emitter resistor check.

chromed, and rounded jaws of some of the popular small drills. They won't close on a No. 76 drill! And you need slow speed too.

I also cut the pins in half, using a diagonal cut to leave a point on them, and then hammered them in through the strip. The final results are shown in Figs. 1A and 1B. They work! If you know how to make smaller ones than these, please let me know.

Figure 3 shows a handy bench type power supply using two lantern type batteries with 6W dc capacity, rated at .5A by the National Carbon Co. (Everready). This is a maximum, by the way, but will give you plenty of sock from a hill or mountain top with a good beam on 432 MHz.

Check the grounded terminals in your car so you can plug this unit in for mobile work if you wish. It is possible to arrange the baseboard to be isolated from the chassis (minibox) if you have to. The only rough part is the bypassing of the output connector. It can be done, though.

The meter business is not too complicated. As the oscillator stage and each doubler stage is built, connect in a meter as in Fig. 4. When this stage is tuned up and the current adjusted to what you want, solder in an emitter resistor of the proper value, and remove the meter and pot. Of course you can build the whole unit, connect it up, and have it work. Only you have to be lucky, and you won't learn as much.

Tuned Diode Power Monitors

If you've read at least half of my articles, you've met these before, and they are useful. Figure 5 shows a quickie on how they are made. Rf from the stage under test goes on a 50Ω cable to the diode unit. C2 provides some matching, C1 tunes L1, and C3 bypasses the rectified rf

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8/73

and puts out dc to the test meter. This serves to: A) Tune up and check on the desired harmonic which in this case is always the second or doubling frequency; and B) Watch the power output. I have a series of these units here covering 2.3 to 10, 25 to 75, 112 to 216, 125 to 260, 160 to 475, 890 to 1320 MHz, and a coaxial one going from 350 to 1700 MHz. Also one for 1 to 12 GHz, but that one is a complete story in itself.

When you're down in the 1 to 50 mW region, things can be tough without a power meter, but power meters are relatively expensive. Here's how to get by. The usual diodes (good ones), tuned circuits, and meters, in the frequency range of 100–3000 MHz will produce about 5V dc into a 500 μA meter, with suitable resistors in series, using a box as shown in Fig. 5. At about this voltage a No. 48 or 49 bulb, which uses 2V at 60 mA, which looks like 120 mW, can be made to light with the rf on it. You have to match it carefully into the circuit, I might say, and maybe turn out the bench light in order to see that dull cherry red glow. Anytime I could light a bulb with rf in the last 40 years, I could work someone!

The Circuit

The final schematic, Fig. 6, and the parts layout, Fig. 7, are given now for clarity of reference in the following details. This circuit, using doubling multiplier stages only, was made up as a direct comparison to a three-transistor tripling

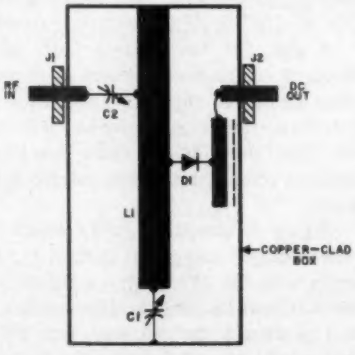

Fig. 5. Tuned detector. Box is 10 x 5 x 5 cm.

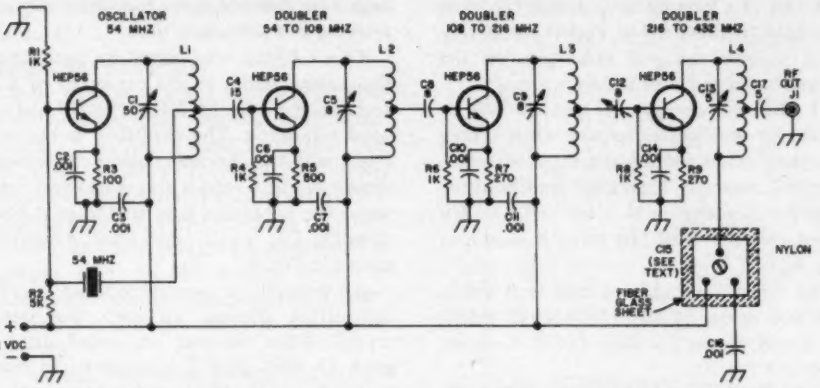

Fig. 6. Schematic. Transistors – All Motorola, HEP56, L2, 20 turns, centertapped, No. 26 DSC, on 5 mm OD phenolic, air core; L2, 10 turns on 5 mm form, No. 26; L3, 5 turns on 5 mm form, No. 28, about 1 cm long; L4, 3 turns, tinned bus wire, No. 18, about 1 cm long, tapped 1 turn from grounded (rf) end, 5 mm diameter.

exciter. The tripling exciter is a nice unit and it turns out to be excellent for a signal source, as a local oscillator, for calibration purposes, etc., but the fact remains that this doubling unit puts out more than four times the rf power at 432 MHz. This is somewhat to be expected as there are four transistors working on the job against only three in the tripling unit, but it was worthwhile to check them both in actual operation. It might be possible to put out more power with more expensive transistors, but this article describes a means of getting crystal control at 432 MHz which is *not* expensive. It fits in a little 5 x 10 cm minibox, and power amplifiers in the same size box have been built here and are being tested and tuned up.

The total current drain runs at only 25 to 30 mils at 12V, or less than .4W dc power, leaving another 5W battery capacity in those lantern jobs for amplifiers. So, on to the construction.

Construction

The stage-by-stage method is used here in order to get the most out of each transistor and at the same time check the possible variable parameters involved and to avoid marginal operation. The oscillator should start every time; the load on it should not be too large; the multipliers should tune nicely above and below the desired doubling frequency, etc. The emitter circuit current meter and the rf output connector can be shifted as each stage is finished, and checked for frequency and power output. Of course you can build the whole thing right off exactly as shown, and it *ought* to work. However, you might have more fun and learn more doing it stage by stage. Your choice entirely.

The oscillator was assembled and wired as in Fig. 8 and connected for tests. There is a small bakelite plank between L1 and the baseboard, and another one under the crystal socket, to keep the terminals from shorting out to ground. You have to take care in soldering those little pins, but you will be surprised after a few tries how strong they really are and how easily the whole assembly goes together. After all, if you want nice little camera-case rigs, this is what you have to do.

The base of each little pin is surrounded by insulation which keeps the wires and components from shorting to ground. The thin copper baseboard solders with a touch, and there is plenty of room for the few resistors and capacitors needed, and they all fit nicely in the layout as shown in Fig. 7. There is even room for another stage, which might be an rf power amplifier. There is only one wire on each of the three coupling capacitors that does not have a pin support, which is the centertap on the multiplier coils, and this holds up

one end of a silvered mica which I think is too light to shake loose. Purists for mechanical rigidity can put three pins on the planks under the coils if they wish.

I also use an external pot of 100 or 500Ω for the emitter resistor while tuning up, then when the desired value is found – which depends somewhat on the drive required for the next stage – R3 is soldered in place. This test setup is shown in Fig. 4.

L1 and C1 should resonate well above and well below 54 MHz. Do *not* rely solely on a grid dipper for this. Check it out as shown in Fig. 8.

You should also listen to the carrier on a communications type receiver, not in the CW position, but with plenty of af gain so you can hear spurious, squegging, and other assorted squeaks and groans. These can easily be eliminated by proper tuning and bias, if you know they're present.

As C1 is reduced toward resonance, the rf should increase to a maximum and then drop off with a snap. Back off slightly from resonance and find the position where it comes on every time and still has near maximum power output.

Trouble

This showed up, as usual. I might say in passing that these bugs are not of my invention. They are real, and I feel you should know about them. Some of these bugs have cost me as much as three days of rewiring and debugging time.

One I found was caused by connecting the output cable to the centertap of L1, and also the only 54 MHz crystal I had on hand was weak. The oscillator works perfectly with the alternate output connection shown in Fig. 8, and it also works very well when the centertap goes to the next base through C4, as in the final schematic shown in Fig. 6.

An interesting, unexpected and beneficial effect showed up with the weak crystal. When the unit was tested, using a good 53 MHz crystal I happened to have on hand, just for fun I tried out the weaker 54 MHz one. As a result of the excess gain of the three doubling stages, particularly the first two, the rf output was almost the same!

This oscillator shows good, stable rf power out of about 50 mW at 18 mA of collector current. Listening to it on my Ameco RE-5 transistor lab receiver, .5 to 54 MHz, it stayed in the passband (of the receiver) nicely, no matter how I tuned the oscillator.

Note that the base of Q1 is *in phase* with the collector except on the crystal frequency. The crystal reverses the phase and it then oscillates, but only on the crystal frequency. Anywhere else it is degenerative – that is, it has negative feedback. I have specified this circuit many

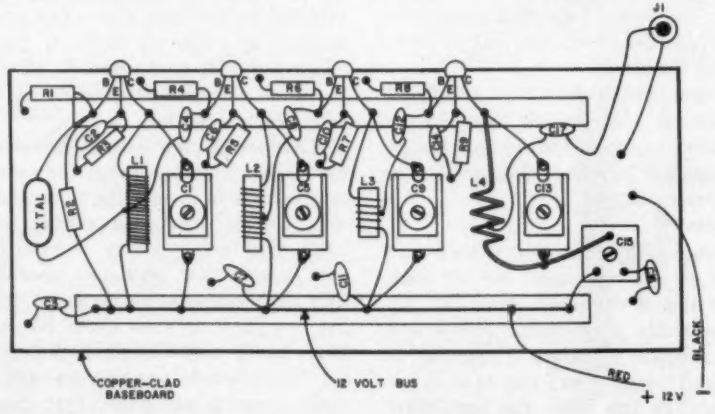

Fig. 7. Pictorial diagram and parts layout. Board size is 4 x 9 cm.

times, but feel it is a good thing to keep stressing it.

Doubler, 54 to 108 MHz

Refer to Figs. 6 and 7 for this one. This multiplier stage went together pretty well, although it proved a good thing that the 108 MHz doubling frequency was being monitored while tuning up L2 and C5. This doubling stage showed a lot more rf power output than the tripling stage mentioned. I obtained over 5V dc output from the tuned diode monitor, which is near 50 mW. The best I could ever do with the tripler was some 3V dc.

I wound two turns around L2 for an output coil for this test, then removed it later.

The emitter resistor check of Fig. 4 was also used here. The final value for best doubling to 108 MHz was 500Ω. Don't forget that different transistors, even of the same number and manufacturer, may require slightly different bias voltages, especially in harmonic multiplier service.

The tuning capacitor across L2, which is C5, was checked for a return to ground or a return to the low end of L2 and no difference was seen.

A choke coil was also substituted for the base resistor R4 and again no difference was noted, so the resistor was left in. An rfc here has caused trouble in the past with spurious oscillation under certain conditions.

Second Doubler, 108 to 216 MHz

This one went together like a charm with the only difference being C8, the coupling capacitor from the previous stage. This showed a preferred value of pF for maximum power out when a variable capacitor was used. A fixed one of 8 pF was installed as the best value. Not really critical, but it is good to have the best value.

The best emitter resistor value was found to be 270Ω for this stage. Again, a two turn coil was wrapped around L3 for an output check on 216 MHz, and was later removed. Again, 5V dc was found at the output of the diode monitor on 216 MHz. So, only one more doubler to go.

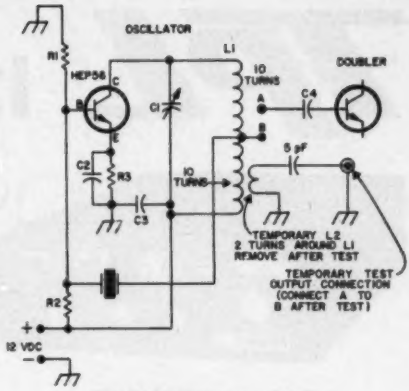

Fig. 8. Oscillator test detail.

Doubler, 216 to 432 MHz

Here I left the variable coupling capacitor in circuit because it peaked up the power output so nicely. Evidently this is a useful device for VHF/UHF multipliers. It probably has to do with matching the lowered base impedances as you go up in frequency. The best emitter resistor value checked out at 270Ω the same as the previous stage, with a collector current about 5 mA.

C15 is a brass plate bypass put in for security at 432 MHz. C16 was added also for a small improvement.

Various output taps on L4 were tried, with one turn from ground showing up as best. And there you are, on 432 MHz.

This complete crystal controlled exciter, fitting into a 5 x 10 cm minibox, using doublers, gives rf power output which is at least four times greater than the same type of unit using tripler stages. So, this one will be the new exciter for my battery portable rig on 432 MHz, and I can use the tripling unit for an LO, after tuning it up on 404 MHz, for use with a tunable 28 MHz i-f amplifier.

Of course, if you're starting in fresh, you might want to build two doubler type multipliers at the same time, tuning one to your LO frequency and the other to 432 MHz. That's up to you, and as for me, I'm working on rf power amplifiers for the band.

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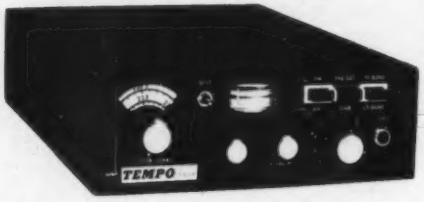

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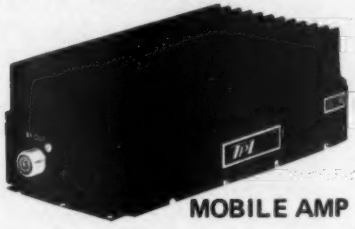

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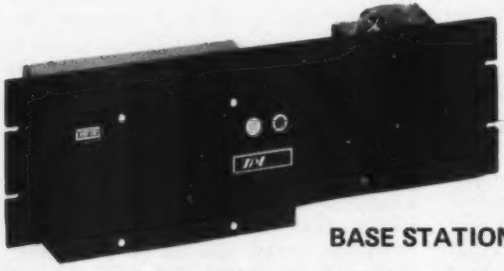

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PA3-1DC	5-15W	30-55W	"
PA3-1ED	50-250mw	60-80W	"

PART NO.	INPUT POWER	OUTPUT POWER	FREQUENCY RANGE
PA3-1DD	5-15W	60-80W	136-175MHz
PA3-1EE	50-250mw	80-120W	"
PA3-1AE	.75-3W	80-120W	"
PA3-1DE	5-15W	80-120W	"
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Frequency modulation is capable of the highest quality of audio transmission of the known modulation systems and it is competitive with the best of them for communications effectiveness. At the same time, it is one of the more sensitive modes in respect to proper adjustment. Although it sounds paradoxical, it is possible to have "low audio" on a signal that is overdeviating.

"Talk power" for the purposes of this article will be defined as "high apparent loudness and intelligibility." Have you ever noticed how loud the modulation on some signals sounds compared with others? This disparity can exist despite the fact that signals at both extremes can have the same deviation setting.

Such differences between signals are attributable to the audio processing prior to the modulation process. A completely linear system would have broadcast quality, but it couldn't compete with a well-adjusted nonlinear processing system for communications effectiveness. Any attempt to increase talk power without nonlinear processing by increasing the deviation setting simply results in overdeviation.

Evils of Overmodulation – FM vs AM

In an AM signal, overmodulation causes flattened peaks on the detected audio at the receiving end of the system. To be sure, an overmodulated AM signal is undesirable because of sideband "splatter," but in moderate amounts it increases talk power due to clipping, as shown in Fig. 1. Because of the high peak-to-average ratio in the average voice waveform, clipping increases the talk power of the signal. In moderate amounts the resulting distortion isn't enough to offset the increase in loudness; thus an increase in communications effectiveness is achieved. Clipping and filtering systems are used in AM systems to exploit this advantage without generating sideband splatter. These systems work because the clipping process is accomplished at a point in the audio path where subsequent filtering can remove the higher-order distortion products prior to modulation. These higher-order products are responsible for the splatter generated without filtering. When clipping is left to the modulation process itself (overmodulating) no filtering action can take place. The point is that the receiver doesn't know the difference between a clipped and filtered signal and an overmodulated one. In either case,

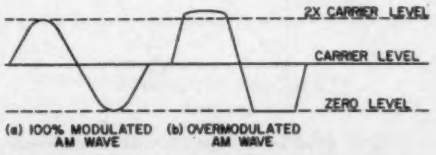


Fig. 1. Detected AM waveforms for a sinusoidal input.

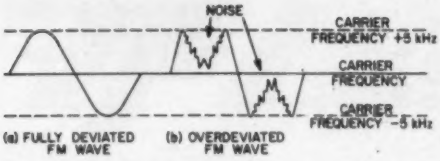


Fig. 2. Detected FM waveforms for a sinusoidal input.

talk power is higher than it is on an unclipped signal.

Such is not the case on FM. Compare the overdeviated signal of Fig. 2 to the overmodulated AM signal of Fig. 1. In contrast to the clipped AM waveform, the overdeviated FM signal sounds raspy and distorted. In fact, instead of sounding louder, the fundamental wave is decreased in amplitude and distortion products are vastly increased (see Fig. 3). The reason for this phenomenon is that the signal passes out of the receiver passband twice for each cycle of audio, once on the high side and once on the low. During the periods that the signal is "gone," the discriminator output produces receiver noise. Compounding the problem, the high-order distortion products so generated get into the squelch noise amplifier of the receiver, causing the squelch to "chop" on audio peaks.

There are two ways to keep overdeviation from occurring. One is simply to keep the audio applied to the modulator at a low enough level. This approach never works satisfactorily in amateur communications. Remember, most FM rigs have an effective processing system. When you receive a modulation report, it is a comparison against these systems. If you don't have nonlinear processing the report will always be "low audio," even if you overdeviate on peaks.

In all commercial FM services an automatic deviation-limiting system of some sort is required by the FCC. Primarily this requirement is to prevent the adjacent-channel interference overdeviation would produce, but such limiting has the further advantage to the user that it improves communications effectiveness when the limiter is put to work as an audio processor. As a deviation limiter the audio level is held to a low value so that only the occasional peak is clipped, but as an audio processor the level is pushed up so as to make the limiter work almost constantly.

Processing Process

The usual processing system is built around a clipper similar to those effective AM systems. A low-pass filter follows the clipper to remove the offending high-order harmonics generated in the clipper. FM systems go a step further in the addition of a pre-emphasis process before clipping. Pre-emphasis is the process whereby the high audio frequencies are amplified more than the lows at the transmitting end of a system. To prevent a "tinny" sound at the receiving end, the receiver demodulator has a de-emphasis circuit that restores the original frequency response. For commercial and amateur communications systems the standard pre-emphasis curve is 6 dB per octave bettwen 300 and 3000 Hz.

Pre-emphasis is based upon the fact that the average power in the higher frequency range of a human voice is much lower in amplitude than the lows. By pre-emphasizing

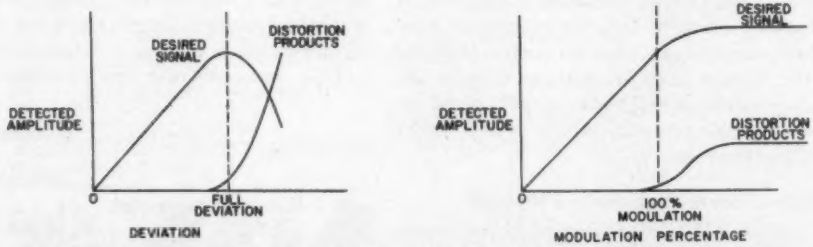
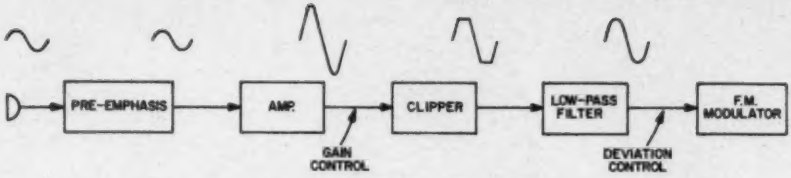
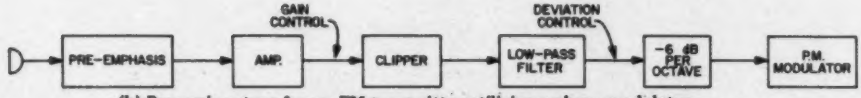


Fig. 3. When an AM signal overmodulates (right) there is no loss of response to the desired signal while distortion products increase only to a point. When an FM signal overdeviates (left) the desired signal response decays rapidly and distortion products increase drastically.



(a) Block diagram showing processing steps required in an FM transmitter.



(b) Processing steps for an FM transmitter utilizing a phase modulator.

Fig. 4. Sequence of processing for FM transmitters, showing the location of gain and deviation controls.

the highs they are raised in level further above whatever noise might be picked up en route to the receiver. When the highs are again de-emphasized to their original level, some of the noise is also de-emphasized with them.

Figure 4(a) shows the sequence of steps used in an FM processor. Pre-emphasis is applied early in the speech amplifier, often before the first amplifier stage, to prevent enhancement of any distortion products from the early amplifier stages by the network. The pre-emphasized signal is then clipped and passed through a low-pass filter to the modulator.

At the receiver the signal is recovered in the form of audio by the discriminator, de-emphasized to restore frequency response and amplified to drive a speaker. The only net changes in audio characteristics between the microphone and the loudspeaker are due to the clipper (plus any degradation due to incidental nonlinearities in circuits or noise picked up en route).

It is important to understand why the gain the deviation pots are located as shown. The deviation pot is between the clipper and modulator while the gain control can be located anywhere before the clipper. Figure 5 illustrates the effect of adjusting the deviation control. In (a) the clipped signal is set to less than 5 kHz deviation (a narrow-band system). Although the processing helps to offset the low deviation setting, this signal won't have the effectiveness of a fully-deviated signal, as shown in (b). Note that the clipping threshold is set just below the 5 kHz limit, preventing the signal from passing

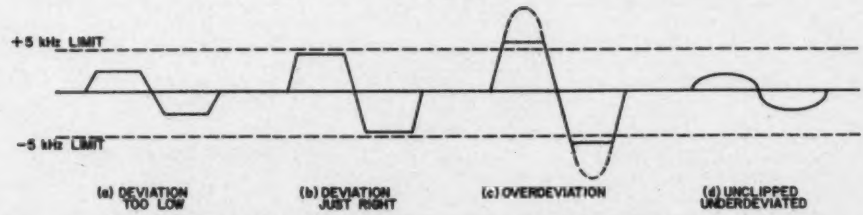


Fig. 5. Effect of deviation control on modulation. A clipped wave is shown to reveal the clipping threshold relative to the deviation level. Dotted lines on the overdeviated wave indicate waveform if unclipped.

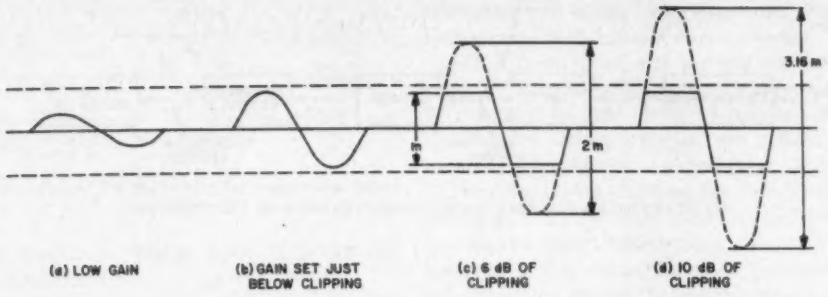


Fig. 6. Effect of gain control adjustment with deviation control properly set. Dotted lines on clipped waveforms indicate the amplitude of the waves if they were not clipped.

outside of the receiver i-f limits. An overdeviated adjustment is shown in Fig. 5(c). Note that the deviation is held down by clipping, but since it is just outside of the passband of the receiver on both sides it sounds the same as an unclipped, vastly overdeviated signal (illustrated by the dotted line waveform). The benefits of clipping are completely defeated on this signal. In Fig. 5(d) a low-deviation sine wave is shown. Can you tell where the deviation limit setting is for this signal? Of course not, because the limit is only visible when the signal is high enough to show clipping. This example illustrates the futility of adjusting the deviation of a rig with a low-amplitude signal not "hitting" the clipping threshold.

On the other hand, the effects of adjusting the gain control are shown in Fig. 6. Note that the overdeviation can't occur at any setting, provided the deviation setting is correct. Only the amount of clipping is

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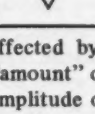

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affected by turning the gain control. (The "amount" of clipping is the ratio of the peak amplitude of the unclipped wave to the peak amplitude of the clipped wave, expressed in dB.)

Most commercial rigs don't have gain controls at all, and many lack sufficient gain to operate the clipper. In the latter case the only way to get good "talk power" is to speak louder, change to a microphone with higher output or add an amplifier stage.

Phase Modulation

It is usually simpler to generate phase modulation than true FM, because phase modulation can be applied to a subsequent stage and be independent of the oscillator. However, in a phase modulator the same modulating voltage at different audio frequencies produces different amounts of deviation, whereas in a true FM system all frequencies are deviated equally. In order to equalize the response of a PM transmitter so as to provide an FM signal, an extra processing step is needed. Between the clipper and the modulator it is necessary to insert an R-C network having less output at high audio frequencies than at low ones. The amount of rolloff necessary is 6 dB per octave. Figure 4(b) illustrates the sequence of processing steps required in a phase-modulated transmitter.

The Real World

A practical effect of voice waveforms (in contrast to the sine waves used in the illustrations) is that different voices make a difference in the resulting overall effectiveness of the system. Some voices don't even need clipping to sound good, while others need large amounts of it. You may find that the effectiveness of your signal can be improved as a result of experimentation with the speech amplifier frequency response and the amount of clipping.

You'll probably find disagreement of reports in on-the-air tests. Some of the disparity is attributable to subjective preferences, but most commonly it is due to differences in receivers. In FM the modulation limit is set by the receiver bandpass characteristics instead of natural boundaries

at the transmitter in AM. Thus one receiver may accept only 5 kHz of deviation while another accepts 10 kHz before overdeviation is apparent. In order to resolve this problem an artificial standard of deviation must be set. Most amateur FM groups have shifted from the wide-(15 kHz) to the narrow-(5 kHz) band standard as of this writing.

Notice that the term "receiver bandwidth characteristics" has replaced the common reference to "receiver bandwidth." Depending upon the design of the receiver, there are varying degrees of difference between actual and theoretical responses to overdeviation. Figure 7 shows two receiver passband response curves. Both are 15 kHz wide at the 3 dB point, hence they have the same bandwidth, right? Not necessarily. Due to the fact that FM receivers use limiters and to the resulting capture effect, stronger signals work farther down the sides of the filter response curve than weak ones. The limiters level off the filter response curve above the point at which the signal line crosses the filter curve. For the receiver in (a) the bandwidth is 15 kHz at the 3 dB point, but it increases to 25 kHz for a signal 10 dB stronger. The receiver at (b), with a better i-f filter, holds the deviation limit more nearly constant with varying signal strength. It can be seen that the (a) receiver is less reliable for adjusting deviation because the deviation limits vary greatly with signal strength.

This effect explains why "compromise" deviation is popular. Narrow-band receivers will accept wider deviation if the signal is strong enough. Where you lose is in ultimate range, where you would like to get the most from your equipment. For maximum range and effectiveness with a given amount of power the transmitter deviation must be matched to the receiver bandwidth at a level near the receiver sensitivity threshold. The receiver at (a) would show better quieting than the one at (b) because its response is greatest at the center of the passband. The test carrier, having no "width," produces a greater response at the center of the passband in (a) than in (b). However, the (a) receiver would show distortion on weak signals because the bandwidth approaches zero as the signal drops in level, while the (b) receiver would recover the modulation

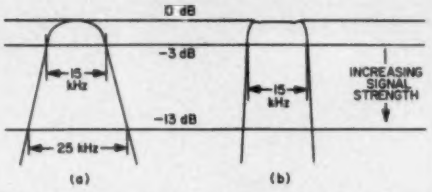

Fig. 7. Comparison of bandwidth at different points of the passband of two receivers. Stronger signals find the receiver effectively wider than weak ones.

clearly. The test of a good receiver is how the signal sounds as it fades out. A good receiver doesn't show distortion on a properly modulated signal as it fades out. Audio output and quality remains constant, and the impression it gives is that the noise level rises to "bury" the signal, rather than the signal dropping into the noise. A ripply pass-band (non-flat passband response) also degrades receiver weak-signal response.

In any case, any receiver deviation test requires that the transmitter carrier frequency be accurately centered on the receiver passband. An off-frequency condition sounds like overdeviation even when the deviation level is correct.

Clipping – Hard or Soft?

Ideally, a clipper leaves all parts of a wave that are below the clipping threshold undistorted, and limits to a constant value all parts exceeding the threshold. Once the threshold is reached, any further increase in input level has no effect on the output

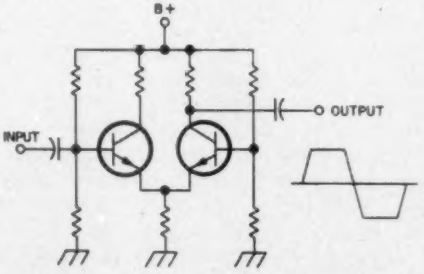

Fig. 8. A differential amplifier is a good example of a "hard" clipper circuit.

amplitude. Such a clipper circuit is termed "hard" and is the best for holding the line on deviation. A differential amplifier circuit such as that shown in Fig. 8 approaches the ideal hard clipper characteristics when operated into saturation.

Other clipping circuits such as the diode circuit of Fig. 9 have varying degrees of "softness." In a sense a soft clipper is a compromise between no clipper at all and a hard clipper, and an infinite variation of "softness" is possible. Because the output continues to rise slightly with increasing input amplitude, the deviation level for a soft clipper must be set somewhat lower at the clipping threshold than the desired maximum deviation level. The advantage of a soft clipper is that the output contains less distortion and requires less filtering.

In either case it is imperative that clipping action take place symmetrically on the positive and negative peaks. If either the shape or the amplitude of the clipped wave differs in the two polarities, a whole new set of distortion products is generated, consisting of even-order harmonics. A symmetrical wave contains only odd harmonics while an asymmetric clipped waveform contains both evens and odds. Another disadvantage of poor symmetry is that talk power is compromised, since the higher-amplitude peak determines the deviation setting. If the other peak is significantly lower it won't reach full deviation.

Better Ways

A compression amplifier, when used in combination with a clipper-filter, forms an improved speech processing system. The compression amplifier acts to maintain a constant average voice level at the input of the clipper, thereby regulating the amount of clipping to a predetermined value. Thus, talk power is maintained at a constant level, even if you drift from the microphone. A compression amplifier by itself can help correct for poor microphone technique, but it can't raise talk power much because it doesn't alter the voice waveform. It doesn't operate instantaneously as does a clipper, hence it can permit bursts of overdeviation. However, when it is used in combination with a clipper a compression amplifier is very effective.

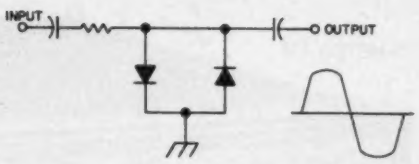

Fig. 9. A diode clipped produces an output having some degree of "softness," depending upon diode characteristics.

Points to Remember

Before adjusting deviation:

(1) Use a receiver with the correct bandwidth.
(2) Make sure the receiver and the transmitter to be adjusted are exactly on the same frequency.
(3) Set the level with sufficient audio input to reach the clipping threshold. If in doubt, look for the clipped waveform on a scope.
(4) Use a weak signal at the receiver – preferably with a trace of noise to prevent widening of the effective receiver bandwidth.
(5) Once the deviation setting is properly made, don't touch it again. If "low audio" reports persist, raise the audio gain, not the deviation.
(6) Audio quality must be maintained at both ends of a radio link. Before you use your receiver to critique other signals, make sure it is matched in frequency and bandwidth with the appropriate standards.

Even with infinite clipping the human voice remains highly intelligible (J. Licklider and I. Pollack, "Effects of Differentiation, Integration, and Infinite Peak Clipping upon the Intelligibility of Speech," *Journal of the Acoustical Society of America*, vol. 18, pp 42–51; January 1947). However, only a modest amount of clipping is needed to produce a large improvement in intelligibility under marginal signal conditions. Hmm . . . I wonder if there isn't some way to improve the intelligibility of a technical article by . . . !

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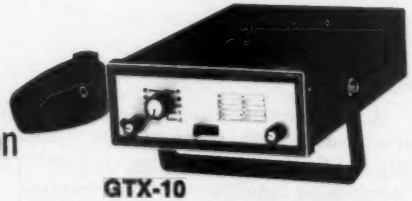

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FCC RULES AND REGULATIONS, PART 97 (III)

Continuing from last month the complete text of the FCC Rules & Regulations pertaining to the Amateur Radio Service.

CONTENTS THIS MONTH

97.40 Station license required.
97.41 Application for station license.
97.43 Location of station.
97.45 Limitations on antenna structures.
97.47 Renewal and/or modification of amateur station license.
97.49 Commission modification of station license.

CALL SIGNS

97.51 Assignment of call signs.
97.53 Policies and procedures applicable to assignment of call signs.

DUPLICATE LICENSES AND LICENSE TERM

97.57 Duplicate license.
97.59 License term.

§ 97.40 Station license required.

(a) No transmitting station shall be operated in the amateur radio service without being licensed by the Federal Communications Commission.

(b) Every amateur radio operator must have a primary amateur radio station license.

(c) An amateur radio operator may be issued one or more additional station licenses, each for a different land location, except that repeater station, control station, and auxiliary link station licenses may also be issued to an amateur radio operator for land locations where another station license has been issued to the applicant.

(d) Any transmitter to be operated as part of a control link shall be licensed as a control station or as an auxiliary link station and may be combined with a primary, secondary, or club station license at the same location.

(e) A transmitter may only be operated as a repeater station under the authority of a repeater station license.

[*§ 97.40 added eff. 10-17-72; VI(72)-1*]

§ 97.41 Application for station license.

(a) Each application for a club or military recreation station license in the amateur radio service shall be made on the FCC Form 610-B. Each application for any other amateur radio station license shall be made on the FCC Form 610.

(b) Each application shall state whether the proposed station is a primary or additional station. If the latter, the application shall also state whether the proposed station is a secondary, control, auxiliary link, or repeater station.

(c) When an application(s) is made for a station having one or more associated stations, i.e., control station and/or auxiliary link station, a system network diagram shall also be submitted.

(d) Each application to license a remotely controlled amateur radio station, whether by wire or by radio control, shall be accompanied by a statement giving the address for each control point. The application shall include a functional block diagram and a technical explanation sufficient to describe the operation of the control link. Additionally, the following shall be provided:

(1) Description of the measures proposed for protection against access to the remote station by unauthorized persons.

(2) Description of the measures proposed for protection against unauthorized station operation, either through activation of the control link or otherwise.

(3) Description of the provisions for shutting down the station in case of control link malfunction.

(4) Description of the means to be provided for monitoring the transmitting frequencies.

(5) Photocopies of control station license(s) and auxiliary link station license(s), or the application(s) for same if such stations are proposed for the system network.

(e) Each application to license a control station or an auxiliary link station in the amateur radio service must be accompanied by the following information:

(1) The station transmitting band(s).

(2) Description of the means to be provided for monitoring the transmitting frequencies.

(3) The transmitter power input and justification that such power is in compliance with § 97.67(b).

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(4) If remote control of an auxiliary link station is proposed, all of the information required by paragraph (d) of this section shall also be provided.

(f) Each application to license a repeater station in the amateur radio service must include the following information for each frequency band proposed for operation.

(1) Location of the station transmitting antenna, drawn upon a topographic map having the scale of 1:250,000 and a contour interval of 50 feet.[1]

(2) The transmitting antenna height above average terrain.[2]

---

[1] **See pages 50 and 51 in the July issue of 73 for ordering information.**

[2] **See Appendix 5, reprinted in part below:**

DETERMINATION OF ANTENNA HEIGHT ABOVE AVERAGE TERRAIN

The effective height of the transmitting antenna shall be the height of the antenna's center of radiation above "average terrain." For this purpose "effective height" shall be established as follows:

(a) On a U.S. Geological Survey Map having a scale of 1:250,000, lay out eight evenly spaced radials, extending from the transmitter site to a distance of 10 miles and beginning at (0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° T.) If preferred, maps of greater scale may be used.

(b) By reference to the map contour lines, established the ground elevation above mean sea level (AMSL) at 2, 4, 6, 8, and 10 miles from the antenna structure along each radial. If no elevation figure or contour line exists for any particular point, the nearest contour line elevation shall be employed.

(c) Calculate the arithmetic average of these 40 points of elevation (5 points of each of 8 radials).

(d) The height above average terrain of the antenna is thus the height AMSL of the antenna's center of radiation, minus the height of average terrain as calculated above.

[*Appendix 5 added new eff. 10-17-72; VI(72)-1*]

(3) The effective radiated power in the horizontal plane for the main lobe of the antenna pattern, calculated for maximum transmitter output power.

(4) The transmitter power output with an explanation of the basis for the measurement or computation.

(5) The loss in the transmission line between the transmitter and the antenna expressed in decibels, and method of determination of the loss.

(6) The horizontal and vertical radiation patterns of the transmitting antenna as installed, with reference to true north (for horizontal pattern only), expressed as relative field strength (voltage) or in decibels, drawn upon polar coordinate graph paper, and method of determination of the patterns.

(7) The relative gain of the transmitting antenna in the horizontal plane and method of determination of the gain.

(8) If remote control of the repeater station is proposed, all of the information required by paragraph (d) of this section also shall be provided.

(9) If auxiliary link station(s) are also proposed, include photocopies of the auxiliary link station license(s), or the application(s) for such licenses.

(g) One application and all papers incorporated therein and made a part thereof shall be submitted for each amateur station license. If the application is for station license only, it shall be filed directly with the Commission at its Gettysburg, Pa., office. If the application also contains application for any class of amateur operator license, it shall be filed in accordance with the provisions of § 97.11.

(h) Applicants proposing to construct a radio station on a site located on land under the jurisdiction of the U.S. Forest Service, U.S. Department of Agriculture, or the Bureau of Land Management, U.S. Depart-

ment of the Interior, must supply the information and must follow the procedure prescribed by § 1.70 of this chapter.

[§ 97.41 *revised eff. 10–17–72; VI(72)–1*]

§ 97.43 Location of station.

Every amateur station must have one land location, the address of which is designated on the station license. Every amateur radio station must have at least one control point. If the control point location is not the same as the station location, authority to operate the station by remote control is required.

[§ 97.43 *revised eff. 10–17–72; VI(72)–1*]

§ 97.45 Limitations on antenna structures.

(a) Except as provided in paragraph (b) of this section, an antenna for a station in the Amateur Radio Service which exceeds the following height limitations may not be erected or used unless notice has been filed with both the FAA on FAA Form 7460–1 and with the Commission on Form 714 or on the license application form, and prior approval by the Commission has been obtained for:

(1) Any construction or alteration of more than 200 feet in height above ground level at its site (§ 17.7 (a) of this chapter).

(2) Any construction or alteration of greater height than an imaginary surface extending outward and upward at one of the following slopes (§ 17.7(b) of this chapter):

(i) 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of each airport with at least one runway more than 3,200 feet in length, excluding heliports and seaplane bases without specified boundaries, if that airport is either listed in the Airport Directory of the current Airman's Information Manual or is operated by a Federal military agency.

(ii) 50 to 1 for a horizontal distance of 10,000 feet from the nearest point of the nearest runway of each airport with its longest runway no more than 3,200 feet in length, excluding heliports and seaplane bases without specified boundaries, if that airport is either listed in the Airport Directory or is operated by a Federal military agency.

(iii) 25 to 1 for a horizontal distance of 5,000 feet from the nearest point of the nearest landing and takeoff area of each heliport listed in the Airport Directory or operated by a Federal military agency.

(3) Any construction or alteration on an airport listed in the Airport Directory of the Airman's Information Manual (§ 17.7(c) of this chapter).

(b) A notification to the Federal Aviation Administration is not required for any of the following construction or alteration:

(1) Any object that would be shielded by existing structures of a permanent and substantial character or by natural terrain or topographic features of equal or greater height, and would be located in the congested area of a city, town, or settlement where it is evident beyond all reasonable doubt that the structure so shielded will not adversely affect safety in air navigation. Applicants claiming such exemption shall submit a statement with their application to the Commission explaining the basis in detail for their finding (§ 17.14 (a) of this chapter).

(2) Any antenna structure of 20 feet or less in height except one that would increase the height of another antenna structure (§ 17.14(b) of this chapter).

(c) Further details as to whether an aeronautical study and/or obstruction marking and lighting may be required, and specifications for obstruction marking and lighting when required, may be obtained from Part 17 of this chapter, "Construction, Marking, and Lighting of Antenna Structures." Information regarding the inspection and maintenance of antenna structures requiring obstruction marking and lighting is also contained in Part 17 of this chapter.

§ 97.47 Renewal and/or modification of amateur station license.

(a) Application for renewal and/or modification of an individual station license shall be submitted on FCC Form 610, and application for renewal and/or modification of an amateur club or military recreation station shall be submitted on FCC Form 610–B. In every case the application shall be accompanied by the applicant's license or photocopy thereof. Applications for renewal of unexpired licenses must be made during the license term and should be filed not later than 60 days prior to the end of the license term. In any case in which the licensee has, in accordance with the provisions of this chapter, made timely and sufficient application for renewal of an unexpired license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined.

(b) If a license is allowed to expire, application for renewal may be made during a period of grace of 1 year after the expiration date. During this 1-year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be backdated to the date of expiration. An application for an individual station license shall be submitted on FCC Form 610. An application for an amateur club or military recreation station license shall be submitted on FCC Form 610–B. In every case the application shall be accompanied by the applicant's expired license or a photocopy thereof.

(c) When the name of a licensee is changed (without changes in the ownership, control, or corporate structure), or when the mailing address is changed (without changing the authorized location of the amateur radio station) a formal application for modification of license is not required. However, the licensee shall notify the Commission promptly of these changes. The notice, which may be in letter form, shall contain the name and address of the licensee as they appear in the Commission's records, the new name and/or address, as the case may be, and the call sign and the class of operator license. The notice shall be sent to Federal Communications Commission, Gettysburg, Pa., 17325, and a copy shall be maintained with the license of each station until a new license is issued.

(d) When an addition to the control point(s) authorized for a remotely controlled station is desired, an application for modification of the remotely controlled station license shall be submitted. Authorized control points may be deleted by letter notification to the Commission.

(e) Should the licensee desire to effect changes to his station which would significantly change the system network diagram or other technical and operational information on file with the Commission, revised showings for the proposed alterations shall be submitted for approval. An application for modification of the station license is not required.

[§ 97.47 *Note deleted and pars.* (d) & (e) *added eff. 10–17–72; VI(72)–1*]

§ 97.49 Commission modification of station license.

(a) Whenever the Commission shall determine that public interest, convenience, and necessity would be

served, or any treaty ratified by the United States will be more fully complied with, by the modification of any radio station license either for a limited time, or for the duration of the term thereof, it shall issue an order for such licensee to show cause why such license should not be modified.

(b) Such order to show cause shall contain a statement of the grounds and reasons for such proposed modification, and shall specify wherein the said license is required to be modified. It shall require the licensee against whom it is directed to appear at a place and time therein named, in no event to be less than 30 days from the date of receipt of the order, to show cause why the proposed modification should not be made and the order of modification issued.

(c) If the licensee against whom the order to show cause is directed does not appear at the time and place provided in said order, a final order of modification shall issue forthwith.

Call Signs

§ 97.51 Assignment of call signs.

(a) The call signs of amateur stations will be assigned systematically by the Commission with the following exceptions:

(1) A specific unassigned call sign may be reassigned to the most recent holder thereof;

(2) A specific unassigned call sign may be assigned to a previous holder if not under license during the past 5 years;

(3) A specific unassigned call sign may be assigned to an amateur organization in memoriam to a deceased member and former holder thereof;

(4) A specific call sign may be temporarily assigned to a station connected with an event, or events, of general public interest;

(5) One unassigned two-letter call sign (a call sign having two letters following the numeral) may be assigned to a previous holder of a two-letter call sign, the prefix of which consisted of not more than a single letter. Additionally, a two-letter call sign may be assigned to an Amateur Extra Class licensee who submits evidence that he held any amateur radio operator or station license, issued by any agency of the U.S. Government or by any foreign government, 25 years or more prior to the receipt date of an application for such assignment. Applicants for two-letter call signs are not permitted to select a specific assignment except in accordance with subparagraphs (1) and (2) of this paragraph.

(b) An amateur call sign will consist of a sequence of one or two letters, a numeral designating the call sign area, and two or three letters. The call sign areas are as follows:

No.
1. Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.
2. New York, New Jersey.
3. Pennsylvania, Delaware, Maryland, District of Columbia.
4. Virginia, North and South Carolina, Georgia, Florida, Alabama, Tennessee, Kentucky, Puerto Rico and Virgin Islands.
5. Mississippi, Louisiana, Arkansas, Oklahoma, Texas, New Mexico.
6. California, Hawaii and Pacific possessions except those included in area 7.
7. Oregon, Washington, Idaho, Montana, Wyoming, Arizona, Nevada, Utah, Alaska and adjacent islands.
8. Michigan, Ohio, West Virginia.
9. Wisconsin, Illinois, Indiana.
10. Colorado, Nebraska, North and South Dakota, Kansas, Minnesota, Iowa, Missouri.

§ 97.53 Policies and procedures applicable to assignment of call signs.

(a) The following are regarded as preferred call signs:

(1) Two-letter call signs—call signs with a single letter prefix (two-letter prefix in Alaska, Hawaii, and in the U.S. possessions) and a two-letter suffix; e.g. W6AB (KH6AB).

(2) Three-letter call signs—call signs with a single letter prefix and a three-letter suffix; e.g. W6ABC.

(b) An eligible licensee will be permitted to hold only one two-letter call sign. However, a licensee who, by reason of former rule provisions, presently holds more than one such call sign may continue to hold these call signs in the same call sign areas.

(c) Subject to availability, two-letter call signs beginning with the letter "W" will normally be assigned in each call sign area to eligible licensees.

(d) An eligible licensee who holds one or more three-letter call signs must relinquish one of those call signs in order to be assigned a two-letter call sign.

(e) New additional stations will not be assigned a preferred call sign.

(f) An additional station which is presently assigned a preferred call sign will be issued a nonpreferred call sign upon modification of license to show a station location in a different call sign area.

(g) Subject to availability, a basic station will be issued the same type of call sign as the one relinquished upon modification of license to show a station location in a different call sign area.

(1) Licensees will not be assigned specific call signs or their choice of counterpart call signs (call signs with identical suffix letters) under this provision.

(2) When a two-letter call sign is not available in the new call sign area, an eligible licensee may be assigned an available unspecified three-letter call sign.

(h) Call signs which have been unassigned for more than one year are normally available for reassignment.

Duplicate Licenses and License Term

§ 97.57 Duplicate license.

Any licensee requesting a duplicate license to replace an original which has been lost, mutilated, or destroyed, shall submit a statement setting forth the facts regarding the manner in which the original license was lost, mutilated, or destroyed. If, subsequent to receipt by the licensee of the duplicate license, the original license is found, either the duplicate or the original license shall be returned immediately to the Commission.

§ 97.59 License term.

(a) Amateur operator licenses are normally valid for a period of 5 years from the date of issuance of a new or renewed license, except the Novice Class which is normally valid for a period of 2 years from the date of issuance.

(b) The license for an amateur station is normally valid for a period of 5 years from the date of issuance of a new or renewed license, except that an amateur station license issued to the holder of a Novice Class amateur operator license is normally valid for a period of 2 years from the date of issuance. All amateur station licenses, regardless of when issued, will expire on the same date as the licensee's amateur operator license.

(c) A duplicate license or a modified license which is not being renewed shall bear the same expiration date as the license for which it is a modification or duplicate.

(To be continued next month)

(con't. from page 38)

"EIA has estimated that the proposed Class E Service could produce 10 million licenses. . ."

tenna limitations, channel capability, frequency control, etc. Additional comments on recommended receiver characteristics are also invited, as well as estimated equipment costs to the user.

f. The feasibility, cost, operational use and potential effectiveness of automatic transmission of call sign or station identification as an aid to self or Commission enforcement, or for other purposes.

g. Appropriate measures to be followed regarding initial and updated registration of Class E operations for purposes of achieving efficient channel utilization, enforcement follow-up, etc.

h. The feasibility and desirability, including estimated social and economic impact, of phasing out either personal or business use of Class D service @ 27 MHz in favor of the surviving use, in conjunction with the establishment of a new Class E service.

i. The feasibility, desirability, and legality of Commission confiscation, uhder certain conditions, of equipment operated illegally.

11. Any schedule for implementing the new radio service operations at 224–225 MHz will have to consider the availability to the Commission of budget allocations in order to provide for the additional administration and enforcement of rules. EIA has estimated that the proposed Class E Service could produce 10 million licensees. The Commission solicits comments on this and other estimates of total license impact as well as the methodology and/or calculations that support such estimates. Comments are also requested regarding possible procedures for licensing and enforcement which would minimize the administrative burdens resulting from such a large number of users.

12. In the event that a portion of the 220–225 MHz amateur band is reallocated to other services, detailed amendments to the rules governing all services involved will be developed and proposed after review of the comments received in response to this proposal. The proposed amendment of Section 2.106 (Table of Frequency Allocations) is set forth in the attached Appendix .

13. Action herein is being taken pursuant to authority contained in Sections 4(i), 303 and 403 of the Communications Act of 1934, as amended.

14. Pursuant to applicable procedures set out in Section 1.415 of the Commission's Rules, interested parties may file comments on or before September 20, 1973, and reply comments on or before October 22, 1973. All relevant and timely comments and reply comments will be considered before final action is taken in this proceeding. The Commission, additionally, in reaching a decision in this proceeding, may also take into account other relevant information before it.

15. In accordance with the provisions of Section 1.419 of the Commission's Rules, an original and 14 copies of all comments, replies, pleadings, briefs, or other documents shall be furnished the Commission. Responses will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, D.C.

Federal Communications Commission
Ben F. Waple
Secretary

APPENDIX

Part 2 of Chapter 1 of Title 47 of the Code of Federal Regulations is amended as follows:

1. § 2.106 [amended]

UNITED STATES		FEDERAL COMMUNICATIONS COMMISSION				
Band (MHz)	Allocation	Band (MHz)	Service	Class of Station	Frequency (MHz)	Nature
5	6	7	8	9	10	11
***	***	***	***	***	***	***
220–224	G, NG. (US34)	220–224	Amateur. (NG13)	Amateur.		AMATEUR.
224–225	G, NG. (US121)	224–225	Fixed. Mobile. (NG68) (NG69)	Base Fixed. Mobile.		FIXED. MOBILE.

2. NG13 is amended to change the pertinent band limits from 220–225 MHz to 220–224 MHz.

3. New footnotes NG68 and NG69 are added in appropriate numerical sequence to read as follows:

NG 68 In those portions of the States of Texas and New Mexico in the area bounded on the south by parallel 31° 53' N, on the east by longitude 105° 40' W, on the north by parallel 33° 24' N and on the west by longitude 106° 40' W and in the State of Florida the counties of Gulf and Franklin and the contiguous water areas of the Gulf of Mexico extending to 30 miles off shore, the frequency band 224–225 MHz is not available for use by fixed, base and mobile stations between the hours of 0500 and 1800 local time Monday through Friday, inclusive, of each week.

NG 69 Pending the outcome of coordination with Canada and Mexico, fixed and mobile stations are not authorized to operate within ten miles of the international boundary with these countries; base stations are not authorized to operate within twenty miles of the international boundary with these countries.

4. US34 is amended to change the pertinent band limits from 220–225 MHz to 220–224 MHz.

5. A new footnote US121 is added in appropriate numerical sequence to read as follows:

US121 The only non-Government service permitted in the band 224–225 MHz is by stations of the fixed and mobile services. These stations shall be on a secondary basis to and not cause harmful interference to the Government radiolocation service.

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Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

GONSET Communicator III 2 meters $100, Gonset 3063 2 meter power amplifier $75, package $150; Motorola P-33BAC with Ni-Cads 94/94 34/94 $125; Heath HX-20 $110, HR-20 $75, HP-20 $25, HP-10 $35, Hustler 80-10 mobile antennas mast mount $35, package $245; you pay shipping – W5PNY, 2506-A 35th St., Los Alamos, New Mexico 87544.

"AMATEUR RADIO" automobile license plate frames. $3.50 each, $6.00 pair. Will fit most all cars. Center Place Communications, Dept. C, Box 26, Independence, MO 64051.

COMPLETE STATION $525 firm or separate as listed, HT 37 $185, SX101A $155, HA 2 with PS $125, Home Brew Linear (matches HT 37 1000Watts) $100, D104 $15, Johnson Matchbox two 10 element 2 mtr collinears with stacking kit $25; will not sell separate before chance to sell complete. Also have back issues of QST from 1925 up – most complete – send SASE for list – would prefer to sell complete – Write K1VNE, Tom, 22 Lockwood St., Bellows Falls, Vt. or call days 802-254-9988, 802-463-4209.

SSTV Monitor tubes 5 to 12 inch P7 $12.50 to $28.00. Limited quantity 53 and 70 degree yokes $5.00. Sold only with tubes. SASE specs, prices, Lotz W5HCO 750 Florida Boulevard, New Orleans LA 70124.

FOUNDATION for AMATEUR RADIO annual Hamfest Sunday 21 October 1973 at Gaithersburg Maryland Fairgrounds.

ANTIQUE RADIO BUFFS. Do you need a schematic for your radio? For information send S.A.S.E. showing make and model number. K3KUL, Joseph C. Crockett, 762 S. Gulph Road, King of Prussia, Pa., 19406.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis.

Heath IB 101 and Vanguard Scaler	$250
Miida Digipet 60 counter with Digipet 160 converter	$400
Tempo CL 220 220 xcvr	$265
HR2MS 8 ch scanning 2m xcvr 15W	$255
TME-H-LMU 16 ch scanning rcvr 6/2/¾/m	$255
Digital Logiclocks	$80
Midland 13509 220 xcvr	$200
Midland 1520 hand-held 2 meter	$190
SBE 450 450 xcvr	$340
Clegg 27B 2m xcvr	$380
Dycomm 2m repeater	$425
Standard repeater	$550
HR-6 25W	$190
Wilson 6 el. 20m beam (pick-up only)	$250
Wilson 7 el. 15m beam (pick-up only)	$250

SERVO CORP sweeper 2-4 gig sweep up or down 2 settable markers $225.00. NM50A with ps, cables & accessories, $325.00. Beckman R-1 Fitgo amplifier 1000 meg input imped, $125.00. 70/752 VDT nice, $900.00. Alfa-Numeric keyboard from Univac VDT. $40.00. SASE for list. Douglas Craton, 5625 Balfrey Dr., W. Palm Beach, Fla. 33406.

FINDLAY ANNUAL HAMFEST, Riverside Park, Findlay, Ohio – Sunday, Sept. 9 – Advance Donation Tickets $1.00 from C. Foltz W8UN, W. Hobart, Findlay, Ohio 45840.

NATIONAL SECURITY AGENCY miniature printer, in original boxes; Teletype #109000 (Model 51). $8.95 each, or 3 for $25. Include postage for 20 pounds. Jim Cooper, 651 Forest Avenue, Paramus, NJ 07652.

AUGAT 9009 sincs for TO 36 2–$1.50 with 2N173 or 2N441 $2.00. Anyone have some cheap ART 13 or ARC 5, prefer close. 2N173 – 2N441 pulls 4/$1.00. 2N2016 pulls 3/$1.00 with cross reference. SASE for list of test equipment. Trade any items for Valiant, Viking. Linears, good receivers. Will buy if reasonable. 14 typing reperf. with keyboard $10.00. Douglas Craton, 5625 Balfrey Dr., W. Palm Beach, Fla. 33406.

NOVICES: DX-40, HQ 110, Johnson 122 VFO. Johnson T-R switch, SWR meter (both new). Good condition. All shipped for $185. WN4WFA, Box 547, Hudson, N.C. 28638.

GIANT N. E. CONVENTION sponsored by FEMARA Sept. 29 & 30 at Dunfey's Hyannis Resort on Cape Cod. Huge flea market, seminars, FM, SSTV, NEDXCC, AMSAT, YL trips, 2 pools, golf, beaches, sailing. Early bird registration still only $3 from W1ZQQ, 17 Barnes Aveneue, E. Boston, Mass. 02128.

TELETYPE MACHINES by Kleinschmidt. Page Printer with Power Supply, as received from Govt., $59.95. Single tables, excellent condition, $19.95. Page Printer and Reperf combination, as received from Govt., $59.95 ea. Double tables, excellent with Chad Box and Tape compartments for $34.95. Each of the above TT Machines cleaned, oiled and adjusted please add $30.00 ea. TH-5 Converters, transmit and receive on 170 shift, $49.95. Paper winders $14.95. TDMS Teletype Transmitter $19.95. Power Supply $24.95. Freight is collect on all orders. Andy Electronics, Inc./6431 Springer/Houston, Texas. 77017.

CANADIANS – FREE 120 page electronics catalog ETCO-B, 464 McGill, Montreal.

2MTR GE MASTR PRO – 80 watt output, four frequency, fully bandchanged in accordancy with factory specs for the Low Split. Channel Guard on both transmit and receive. Includes crystals for 52/52, 16/76, 28/88 and 34/94, microphone, control head, speaker, control and power cables, fuse block, mobile mounting rack and GE Maintenance Manual. $650. F.O.B. Rapid City. Andy Demartini, WB2VUJ/Ø, PSC Box 1973, Ellsworth AFB, South Dakota 57706.

MIX PLEASURE WITH PLEASURE. 1973 Hamburg International Hamfest on Sept. 15 only 45 minutes from fabulous Niagara Falls. RV parking for weekend only $2.50 with hook-up. Details: Valerie Orgera K2KQC, 187 Main, Hamburg, N.Y. 14075.

SPECIALIZED REPAIR SERVICE We offer a complete repair service on all Collins receivers & transceivers listed. R-388-389-390-390A-392-392. All S-line receivers & transceivers including 51S-1-651S-1 receivers. We stock and sell all parts for the above receivers. We also service all Collins Avionics equipment. Such as Arc-73, Arc-94, Arc-102, Arc-114, Arc-115-116-131-134, Arc-38A, Arc-58, 618-T. We also buy the above Avionics sets any quantity any cond. We will send price list upon request. D & R Electronics, R.D. No.1, Box 56, Milton, Pa. 17847. 1-717-742-4604.

WANT OLD RADIO TRANSCRIPTION DISCS. Any size or speed. Send list and details to Larry Kiner, W7FIZ, 7554 132nd Ave. N.E., Kirkland, Wash. 98033.

HAMFESTERS 39th Hamfest and Picnic, Sunday, August 12, 1973, SANTA FE PARK, 91st and Wolf Road, Willow Springs, Illinois, Southwest of Chicago. Exhibits for OM's and XYL's, Famous Swappers Row. Information contact John Raiger K9DRS, 8919 Golfview, Orland Park, Illinois 60462. Tickets write Joseph Poradyla WA9IWU, 5701 So. California Ave., Chicago, Ill. 60629.

GLADDING 25 – with latest factory modifications – $175. Crystals for Gladding – Transmit 146.01, .13, .16, .22, .25, .28, .31, .46, .52. Receive 146.52, .64, .73, .82, .85, .88, .91, and 147.50. $3 50 each postpaid. Dick Eastman, K1OJH, Box 114, St. Johnsbury, Vermont, 05819.

WARREN HAMFEST Largest family style Hamfest in East. Sunday, August 19th, @ Famous Yankee Lake Park. Giant Fleamarket, Swimming, Picnicking – All Free. Details QSL W8VTD.

FOR SALE: Heathkit SB-300, mint condition, all new tubes, has scarcely been used, $200. Eico 720 transmitter, mint condition, with 722 VFO, the perfect novice transmitter, $100. Model 19 Teletype machine, mint condition, with unshift on space, 75 WPM and 60 WPM gears, $135. Marsan Television Camera, fast-scan, video or RF output, adaptable to SSTV, $180.00. All items are plus shipping. C. Fine, WB2CNH, 570 North Street Harrison, New York 10528. Tel: 914-967-2652.

REGULATED D-C POWER SUPPLY, output 300±25-v., 160-ma., 1-mv ripple. Several unregulated A-C outputs, 115-v/60Hz input. New cond. $100. Lovins, Weston Road, Lincoln, Mass. 01773. 617-259-8938.

TECH MANUALS – $6.50 each: R-389/URR, R-390/URR, R-220/URR, R-274/FRR, TS-382D/U, CV-591A/URR, TS-34A/AP, TS-497B/URR, SP-600JX, RCK, TT-6A/FGC, LM-21, ALR-5, OS-8C/U. W3IHD, 7218 Roanne Drive, Washington, DC 20021.

HOOSIER ELECTRONICS – Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Individual, personal service by experienced and active hams. Factory-authorized dealers for Regency, Genave, Drake, Standard, Clegg, Hallicrafters, Ten-Tec, Kenwood, Tempo, Midland, Galaxy, Mosley, Hy-Gain, CushCraft, Ham-M, Hustler, plus many more. Orders for in-stock merchandise shipped the same day. Write or call today for our quote and try our personal, friendly Hoosier service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana 47802. (812)-894-2397.

NOVICE-TECHNICIAN code for beginners. Voice and code instructions. Cassettes only Send money order to Brobak Sales, Box 172, Mattapan, Mass. 02126. Each $3.25.

ROANOKE DIVISION CONVENTION – Sept. 14–16, 1973, Reston, Va. (near Dulles Airport) Unusual wide interest programs and sessions. Write K4MD, Box 7388, Warrenton, Va. 22186.

WESTERN UNION DESK-FAX transceiver manual: Complete theory of operation, adjustment, lubrication, preventive maintenance, troubleshooting, parts list. Includes all schematics and mechanical parts drawings. $3.80 postpaid. Bill Johnston, 1808 Pomona Drive, Las Cruces, New Mexico 88001.

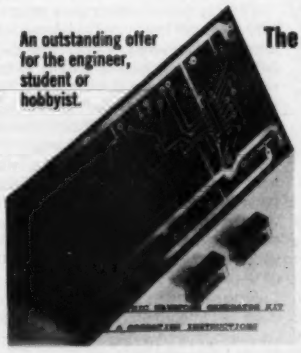
"DON and BOB" guaranteed buys. Discount prices plus full warranty. Triex MW50 tower 250.75; MW65 331.50; W51 386.00 FOBCAL. Ham-M 99.00; TR44 59.95; AR22R 31.95; Belden 8 wire rotor cable #8448 10¢/FT; Mosley CL36 149.00; CL33 124.00; TA33 114.00; MCQ3B 91.00; S402 143.00; MP33 90.00; Belden 8214 RG8FOAM 17¢/ft; Motorola HEP170 Epoxy Diode 2.5A/1000PIV 29¢ 25.00/100; KY65 code ider 5.95; Write specific needs new panel meters, stock; quote discontinued tubes; quote Clegg FM27B; Genave GTX2; Regency HR212; Midland 13500; Standard; Collins and CDE replacement parts; Hallicrafters FPM300 (595.00L) 499.00; Hardbound technical magazines, many types from petrochemical library 3.00/yr write needs. 9PIN ceramic 6LQ6 socket 50¢; 6V/12V/24V/1.5A transformer 2.49; Collins 75A4 345.00; Kenwood T599 350.00. Shipping charges collect. Madison Electronics, 1508 McKinney, Houston, Texas 77002 713/2242668.

SBE 36 9 month old mint transceiver 500 PEP digital readout 80-10 $595. K1RES, Peter Williamson, 132 Winthrop St., Augusta, Maine 04330. 622-1949 after 5:00.

GLOBAL RESEARCH & Supplies. SBE SB-50 $349.95, SB3-AC $42.50. HY-Gain 6 meter Linear 220 watts, mobile #404 $129.95, Base $109.95. Tempo 6n2 KW linear $595.00. Genave GTX-2 $249.95. GTX-10 $199.95, GTX-200 $259.95, Comcraft CTR-144 $489.00. Write for catalog: P.O. Box 271, Lombard, Ill., 60148.

PLASTIC ENGRAVED CALL PLATES w/pin $1.25. WA2UUY, 15 Vincent St., Parlin NJ 08859.

73 FLAG NEEDED – PLEASE. The 73 banner was inadvertently left behind at the Dayton Hamvention in 1971. Last year someone mentioned that they had it and would return it. We hoped that 1973 would be the big year for getting this banner back, but Dayton came and went without same. Please – whoever has the banner – we *need* it. Any info on the whereabouts of our banner will be appreciated.



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4) **Detailed assembly and hook-up instructions with parts list, schematic and layout diagram.**

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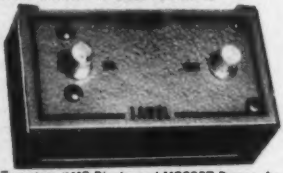

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Preamps with all the above features plus ac Power Supply and Die Cast Cabinet:
Model 432PA-1 (3.5 dB NF) **$54.95**
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PALOMAR ENGINEERS
BOX 455, ESCONDIDO, CA 92025

(W2NSD/1 continued from p.19)

taken by surprise. Thank heavens there are so few of them left.

What I had intended to say to the Midcars group was that I think their type of operation is of immediate and first order importance to amateur radio and to our country. Frankly, I doubt if many amateurs appreciate just how important emergency communications is now and may be in the future.

Those of you who read more than amateur radio magazines are probably aware that a bargain has been struck between the U.S. and the U.S.S.R. regarding nuclear warfare. To put it bluntly, the population of the U.S. is being held hostage – particularly in the larger cities. Ditto the Russian population. The agreement appears to be that we will not pursue civil defense and anti-ballistics missiles if they won't. We see the results – a virtual total decay of CD, with shelters abandoned as a means of safety, and no alternate.

What does this mean to us as radio amateurs? It means that should something ever go wrong with this bargain that the ONLY communications that the country will have will be amateur radio. This is when experience and equipment for the service nets such as Midcars will become valuable beyond reckoning. This is when we will need every repeater we can get – every cross-band system – every mobile – every battery or portable powered base station.

If the leadership and progress of our service nets is in the hands of amateurs like William G. Blankenship K4DLA, then it looks to me as if we are in deep trouble. We need progressive and enthusiastic people to move us along and we must beware of old-timers with frozen thinking.

Contrast the Midcars leadership (or is that the right word?) with that of Eastcars where we have truly far thinking and enlightened amateurs such as Harold Winston WA2DIR as leaders. Poor old Blankenship should have been retired years ago.

PICTURES NEEDED

We're still looking for good pictures for 73 Magazine – of interesting shacks – of slow scan setups – of RTTY stations – mobile installations – anything unusual.

DAMAGE LIMITATION VS ASSURED DESTRUCTION

Those of our readers who also read the *New Yorker* hopefully read the most interesting series on the history of SALT – the Annals of Diplomacy. It is quite revealing.

The series details the history of how McNamara and Johnson came to an "agreement" with Russia on assured destruction. The proponents of damage limitation wanted to try and keep the destruction of a nuclear exchange to a minimum of defensive missiles (ABM'S) and civil defense measures. The assured destruction foes believed that the populations of the two nations should stand totally exposed to destruction so that fear of retaliation would deter the other from striking first.

This agreement on assured destruction explains why civil defense has almost disappeared. About the only detectable civil defense activity is the amateur development of repeater FM systems in those areas where CD officials are not too apathetic to even permit this growth. It must be traumatic for the few people who have a sincere interest in the subject to be stopped from going ahead with shelters, sophisticated communications systems, and other preparation which could help save people in case of the ultimate disaster.

Since amateurs are not dependent upon government funds for setting up communications systems, perhaps it would be prudent to keep in mind the

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SEND FOR FREE DETAILS

SPECIAL 73 CRYSTAL BANK GIFT SUBSCRIPTION OFFER

Provide one full year of enjoyment for a friend with a year's subscription to 73 Magazine — all in exchange for the insignificant sum of $2 and one of your unused two meter FM crystals.

The following benefits will accrue from this exchange:

1. You will soon have a lot more good friends as word gets out that you are giving away subscriptions to 73.

2. 73 will have a lot more new readers - amateurs who will hopefully become psychologically dependent upon the magazine and renew at the end of the gift year at the regular subscription rate - thereby eventually making this deal worthwhile for 73.

3. You will have a way to get rid of all those crystals that have been kicking around after repeaters have changed channels, or you have moved from one repeater area to another.

4. 73 will build up a crystal bank for whatever devilish purposes they may have in mind - whether it be rental of crystals for amateurs on trips - or perhaps even the outright sale of them. They might even cook up some sort of subscription premium arrangement. You never know.

WHAT YOU SEND:

1. The name and address, including call letters and zip, of the friend to be endowed with the gift subscription to 73. If you send this in by August 31, they should start their subscription with the October issue. This offer is valid for new subscriptions only, not for renewals or extensions. For $2 we can't stop and look them up in the computer to see if they are already in there.

2. Send $2 in cash, check, money order, IRC's, or anything negotiable for each gift subscription.

3. Tape each crystal to a 3 x 5 card and mark on the card this data: make of set the crystal was made for - transmit or receive frequency - your name, address, and call on the card in case the crystal is a bummer, in which case we'll need another one, or $4 to buy a new one to replace it in the crystal bank. Crystals for the following transceivers are acceptable: Clegg, Drake, Genave, Gladding, Inoue(Icom), Grove, Pearce-Simpson, Ross and White, SBE, Simpson, Sonar, Standard, Swan, Telecomm, Tempo, Varitronics, Yaesu. Use enough tape to hold the crystal to the card, but please do not overdo it!

official attitude and set up our emergency communications in readiness in spite of them. Here is something we can do that the government can't because of the agreement with Russia.

OVER ID'd

Most, if not all, FMers are chronic identifiers — they give their calls, the calls of the stations they are working, and even the call of the repeater. and they give them repeatedly (if you'll pardon the expression).

The fact is that probably 75% of the identifying is just plain waste of repeater and QSO time. Habit.

The regulations (97.87) require that you identify at the beginning and end of each transmission or an exchange of transmissions and every ten minutes during a transmission or exchange of transmissions. This means that you only have to identify yourself when you start a contact, every ten minutes during a contact, and when you sign off. A contact on a repeater certainly is an exchange of transmissions and would call for ten minute identifications, not at every "over" — which could mean identification of both (or more) parties every two or three minutes. Look at the time you can save!

The repeater is supposedly identifying itself via CW every five minutes. You can identify yourself every two repeater IDs and be on schedule. There is obviously no reason to voice the repeater call — unless you are at such a loss for something to say that you feel you have to fill in dead air with such nonsense.

If you are working one other station you can give his call when you start the contact and again when you end it. You don't need to give it for the ten minute identifications. If you have more than one other chap in the contact you don't even have to acknowledge him. You can sign out when you are leaving by giving just one other call sign and your own, plus an indication that there are others in the net. "K3TUF and the group, this is W2NSD signing out."

When you are operating mobile or portable you should add the call area at the end of your sign . . . "this is W2NSD portable one." It is no longer necessary to give any closer identification than that.

SSTV on 2m FM

A note from one of the repeater frequency coordinator groups the other day suggested the use of 146.58 for RTTY, FAX and SSTV. As a user of slow scan on the lower bands perhaps it is time to explain what this is all about so a misconception like this does not get too much further.

RTTY is a separate mode of communications. When you make an RTTY contact the chances are that you will not be using voice at all, just TT. On the low bands the RTTY channels are in the CW segments so voice is ruled out. Voice is occasionally used on VHF RTTY channels, but it is rare in my experience — which goes back quite a few years. Some RTTY repeaters won't even let anything but TT through.

Now with slow scan — most contacts are mainly voice, with some pictures thrown in now and then. It is possible to have an all slow scan contact — I had one with an EA8 who spoke no English — but this is not very practical. Slow scanners show pictures of their families — their interests — perhaps some humorous drawings, pictures or cartoons. Then they talk a lot about slow scan — or their other interests which the pictures introduced to the contact.

As slow scan becomes more used I would expect to see it coming through the repeaters as part of regular contacts rather than on separate frequencies. A picture only takes eight seconds to transmit — and the usual barrage of three frames of each picture runs you to 24 seconds.

Wayne

(LETTERS cont. from p. 42)

"original cartons" and "unused" – and for only $15.00! What I wouldn't have given for that in 1947 (or was it 1948?).

I was living in the Chicago area at the time, and TV was in its infancy: in fact, there was no such thing as a network cable connection to New York. All programs were local, but don't feel too sorry for us, however, for on the old Motorola 7" screen (complete with bubble magnifier) we saw such local notables as Dave Garroway, Kukla, Fran and Ollie, and Clifton Utley with the news (Garrick Utley's father). But I'm getting ahead of my story.

The Zenith Radio Corporation, a pioneer in radio and TV, developed a system of scrambling a TV picture over the air, and decoding it in the home with a gadget hooked up to a TV set, and also as I recall, to the telephone line. I'm almost positive memory serves me correctly in recalling that Zenith named it Phonovision. Anyhow they received the very first experimental TV license from the FCC in order to conduct a limited experiment in the Chicago area.

Advertisements appeared in the Chicago papers inviting applications from viewers, and if you were accepted a fortunate few hundred families were to be furnished the mysterious black box and hooked up so as to receive the picture "unscrambled," all in the interest of scientific experiment. I do not know how many applications Zenith had, but I do know there was a limit to how many they could accept, and mine wasn't one of them.

Came the start of the test, and Zenith came on the air with first run movies, and other goodies unheard of in those days of 1947. They would sign on the air with a clear signal and tell you what was going to be shown as a feature, and then they would pull the switch or push a button, or whatever they did, but the result would be the most gosh-awful mess you ever saw. For some time they did not scramble the sound, and it about drove me nuts to hear the sound but to be able to make no sense out of the picture. Being a true experimenter, I set to work to see if anything could be done about it.

The best solution consisted of a 10" fan blade mounted on a small rotor whose speed was continuously variable by means of a 110 volt rheostat. If you squinted through the whirling blades, and kept one hand on the speed control, you could do a fair job of unscrambling the picture. In addition you got a breeze, which, if it was a hot night, wasn't too bad. Now as I look at Meshna's ad and pictures of "3 cartons costing Zenith well over $1000.00," I wonder that a simple concoction like a variable speed fan worked at all, but it did – after a fashion.

Finally Zenith went off the air in Chicago as their experimental license expired, and in late '48 or '49 we got hooked up with New York on the coaxial cable, which was I suspect to be the final blow later on to over-the-air pay TV.

Zenith had another experimental period years later in Hartford, Conn., using essentially the same system used in Chicago, and I would assume that Meshna's surplus gear comes from there. Pay TV is by no means a dead issue, but cable TV, via that same coaxial cable, seems to be the means most practical to bring it into your house.

Meanwhile, Mr. Meshna, I'll buy one of these outfits for $15.00 for old times sake, if you will provide a scrambled TV signal for me to unscramble.

R.M. Baldwin K4ZQR
Louisville, Kentucky

SIGNAL/ONE

As one of those who bought a CX7A partly as a response to ads in 73, I hope you'll employ your well known no-holds-barred approach to telling us just what has happened to the Signal/One Company. Also, who might be willing to take care of our apparently orphaned and manual-less rigs.

Ronald E. Wyllys WB5HZN
Austin, Texas

It is our understanding that Don Payne (Payne Radio) has most of the repair parts for the Signal/One units and there should be little problem in getting service. For that matter, it seems likely that there will be a lot less difficulty now than there was when Signal/One was handling the repairs – some of which stretched out for months and months. Hearsay has it that they did not pay the IRS the employee witholding and this resulted in IRS locking up the plant. We understand the ex-president is now in Europe and no "officials" can be reached. It is interesting that despite the problems, the market for the CX-7A has, if anything, increased. This was undoubtedly the finest ham rig ever made and there is no prospect of anything this state of the art in the works in the forseeable future.

CB PROJECT

I built your rig on page 12 of the June issue of 73, and it works fine. The only problem is when I use the slider in the 1 KW position a lot of garage doors seem to open and I had to use tape on the G&H slots because there aren't any tabs, but overall it is a nice rig.

My main concern is that I didn't receive any warranty card!

Rodger Booth
E. Green, Rhode Island

73 SCREWS UP A CB PROJECT

I have received several inquiries about the Citizen Band Alignment Aid (April 73). The coil diameter was omitted. I.D. for L1 is 8 mm. In other words, wind it on a pencil as a form.

Also, a SASE is sufficient postage for the P.C. board.

Ed Lawrence WA5SWD
Plano, Texas

LIKES STUDY GUIDE

I used your Amateur Radio Extra Class License Study Guide as the principal reference in obtaining my Extra-Class License. I was very impressed with both the completeness of the material and the fine way you presented it.

I would certainly recommend it to anyone who was considering studying for the Amateur Extra.

John Ferree W7IYZ
Boise, Idaho

HT-220 PROBLEMS

I have come up with a problem that I hope you can give me some advice on.

About a year ago, my brother and I each purchased an HT-200 "kit" from Spectronics. This kit consisted of the transmitter/receiver PC board, case, battery, and the necessary controls, such as volume and squelch pots.

All we had to do was wire the board into the case, snap in the battery, and away they should go – but not on the desired frequency!!! They have to be padded onto the 146 MHz range as both units appear to be from the hi-hi band, 160–174 MHz.

We wrote both HT-Specialists (Ontario, Can.) and Artic Specialty Co. (Pontiac, Mich.) as they had advertised they were able and willing to do the padding and tune-ups involved. We never heard anything from them so we hunted around for people who either worked for Motorola and could work on them in spare time, or someone with that type of training.

We found two and got *some* work done but for various reasons, they both had to drop the work. This is the point that I'm at now. I just got the two HT's back this morning from the second guy – work not completed, and am stuck with two fully crystalled, dual freq., one watt DEAD 220's.

Can you possibly recommend some firm or person who does these tune-up/padding jobs, short of Motorola (and their $15 per hr. charge)? We have looked around here, but few people have much of a working knowledge of 220's. I would really like to get these radios running because beauties like these shouldn't be lying in a box waiting to be fixed.

I look forward to any advice you can give me, because I've come to the end of my guy wire.

Ken Fowler WA1NSR
E. Middlebury VT

Back before the Standard 146 and Tempo FMH hand units became

generally available, the Motorola HT-220 enjoyed wide favor – since it was essentially the only hand unit available.

There are several drawbacks to the HT's which have encouraged amateurs to go the 146 or FMH route.

For instance there is the matter of the battery. The special batteries for the HT's are quite expensive and difficult to find. In my own experience with a couple of HT's I had to either find Art Housholder (of Spectronics) at a convention with a spare one in his pocket which I could buy or else pay through the nose. The 146 and FMH units use commonly available flashlight battery sized nicads which you can buy at Radio Shack – and at any radio store.

Then there is the problem of service – and it is a serious problem. One of my HT's developed a squeal. I opened it up – froze in horror at the maze of incredibly small parts – and quickly closed it up again. I have been building for years, but I'm not ready to tackle that sort of thing – even if I could find parts for it. I sent it off to Spectronics for repairs – it came back eventually, but still squealed until the day it was stolen. The complaints about HT Specialists kept me from trying them. I didn't know what to do about it except sigh in despair.

With the 146's and the FMH's repair is no problem. Whenever I've had any problems with my 146's I've popped them out to Standard in California and they've come back a few days later all fixed up. They have a number of test benches out there, complete with factory trained servicemen (all amateurs, by the way) who know the Standard units inside and out. I haven't had any problems with the FMH's as yet (no one has dropped them yet), so I haven't any personal experience with the Henry service – but friends say that it is excellent.

The 146 and FMH units are made with small parts, but they are parts that you can walk in and buy – not like some of the micro parts used in the HT's. You need good eyes for the 146 and FMH, not a microscope and the hands of a practiced surgeon.

The 146 has five channels and uses commonly available ($3.75) plug in crystals – the FMH has six channels and uses the same type of inexpensive crystals. Have you priced the precision special crystals used in the HT's? The HT's usually come with one or two channels – so you have maybe 34–94 and 94–94. It is possible to find one with more, but this means you have to have the large (omni) case to hold the crystal switching, which makes the HT almost the size of the 146 and FMH units (same width and thickness, but the HT is about an inch shorter).

One other problem that bothers some operators is the uncertain parentage of many HT's. Since the major market for these units is commercial – the police – FBI – and other agencies which can afford the $800 to $1500 tab for these units – there is a problem wherein it is sometimes difficult for an amateur to know whether his HT has come to him via a legitimate channel or from some clandestine source. Imagine the position of the amateur who goes to a legitimate Motorola repairman with his HT, only to find himself being seriously questioned by the FBI. You wouldn't believe what a complete lack of a sense of humor some of these government agencies can have. I know more than one amateur who is afraid to show his HT where any questions might be asked.

It is nice to have a good idea of just what the price is of your unit too. The 146's and FMH's are advertised and the prices are known. An HT is worth whatever you can get for it, with some going for around $75 and some for ten times that. And what do you do if your HT gets stolen – this has been a serious problem for many amateurs. The 146 and FMH known prices – complete with bona fide sales slip – makes it simple to deal with the insurance company.

If you go the Standard or Tempo route with both hand unit and base or mobile units, you can exchange crystals. I use a Standard in the car as well as the 146's and often I borrow crystals from one for the other. When I'm taking a trip to a distant city I set up the 146 for the local repeaters. This isn't possible with the HT's since the HT crystals normally are soldered in and changing them is a great big difficult deal.

The design of the HT is beautiful – the transmitter is clean – the receiver superb – actually the receiver is a lot better than you need. A two watt hand unit can only transmit so far and it is frustrating to hear a repeater many miles further than you can work with it. Ditto the five watt model HT-220. If Motorola would solve a couple of the simple problems for us the HT's would be a lot more popular. We need available service at ham prices – not $15 per hour commercial service. We need to be able to use inexpensive plug in crystals. We need five or six channels. We need to use inexpensive batteries. How about it, Motorola?

. . . W2NSD/1

REPEATER INFO

Long time since we last wrote to let you know about the FM scene in UK and the rest of Europe. It also gives me the chance to thank you for the copies of 73 (unfortunately postal delays mean that I only received the May copy today).

Since the IARU meeting last May, the FM channels are beginning to get really used on an international basis. The main activity is between 145.500–145.600 at 25 kHz steps.

As to the repeaters, I can only give you definite info on some.

Belgium – 9 planned, awaiting licenses.

Czech – 2 FM 600 kHz spaced operating 1–8 kHz wide all mode translator OKØA. Input 145.1 ± 4 kHz, output 145.7 ± 4 kHz.

Denmark – 12 2m & 1 70 cm operational.

Finland – 1 2m in Helsinki this summer.

Germany – on 25 May 1973. 2 2m RTTY relays. 4 2m 600 kHz relays. 78 2m 1.6 MHz relays, 24 70 cm relays.

Norway – NRRL has a plan for 46 repeaters, awaiting licensing.

Sweden – 21 2m repeater licensed (3 in Stockholm).

Switzerland – 2 2m and 6 70 cm relays.

United Kingdom – still only GB3PI 145.15/75 until August 11th and then we will have to wait and see.

Israel – 1 only near Haifa. 145.175/145.775.

So that is how things are on 11 June 1973. At the moment I am editing the first European repeater directory, deadline July 2nd. I'll see if I can get a copy to you on publication.

Kris Partridge G8AUU
Devon, United Kingdom

CONGRATS

Today I took my Novice exam and passed – and I'm holding every one of you personally responsible! In your October issue you advertised a course given at the Hall of Science in New York. I enrolled immediately. Of course I won't know my call letters for a few weeks but I'll let you know what it is as soon as my ticket arrives. Then I'll really feel like a member of the 73 family of radio amateurs.

Irene Jean Putzer
Brooklyn NY

MANUAL NEEDED

I am hoping your readers can help me. I recently acquired a Delcon Linear Amplifier T210. I would like to know where I could get a manual for this item. I have just the amplifier and will need to build the power supply. I also need to know the type of tubes that it takes. The Delcon Corporation was located in Palo Alto, California.

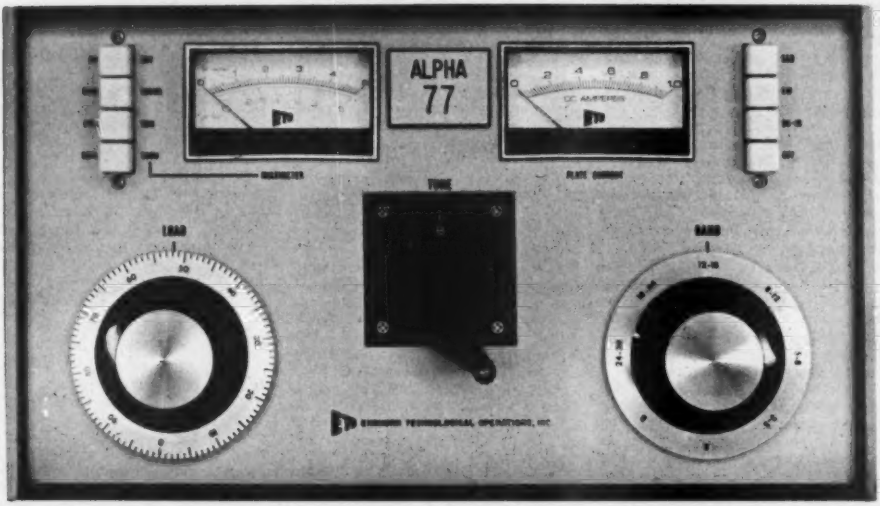
Rudolf Birkenkopt DA1RB/WB2XCS
EES PX, Patch Barracks
APO New York 09131

BULLETIN

I am a regular reader of the Repeater Bulletin and quite active on 2 meter FM. I think the Bulletin excellent and I have always enjoyed the issues of 73 I have picked off the newsstand so much, that I thought it was high time I subscribed.

B. Robert Benson VE2VW
Montreal, Que.

"OPERATING ON-THE-AIR WITH THE **ALPHA 77** IS A PURE PLEASURE"



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(QST — March 1973)

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SSTV-DXDC

Dress up the shack with this award for 2-way slow scan television communications with 10 countries. Endorsement provisions for separate bands. Dated and signed by Wayne Green, Editor and Publisher of 73 Magazine. Enclose postage for return of QSLs. 8½ x 11, light green color, dark green printing, $1.

RRCC Certificate

This Real Rag Chewers certificate is awarded only for the feat of a non-stop QSO for a period exceeding six hours with no time out for anything. Order must be accompanied with date/time (GMT) of start/end of contact, station contacted, and your call. Signed by Wayne Green. Light orange color, black printing $1

All Mode DXDC

How many can qualify for this one? An award for 2-way communications with 10 countries using CW-SSB-RTTY-SSTV modes. Certificate dated and signed by Wayne Green, Editor and Publisher of 73 Magazine. Enclose sufficient postage for return of QSLs. 8½ x 11, light red color, black printing, ...$1.

DXDC Certificate

Available for those who present proof of contact (copy of log) with 10 different countries. Awarding this certificate makes you a member of the DX Decade Club. Numbered and dated and personally signed by Wayne Green, Editor and Publisher of 73 Magazine. Printed on good paper, light purple color, black printing, 8½ x 11, suitable for framing. .....$1.

Understanding XYL/OM

An unusual certificate – get one and keep your mate happy. An award to those who have the good fortune of having an understanding partner who appreciates all good things about amateur radio (staying up all night, spending money for rigs, etc.). Sworn statement attesting to this must be submitted. 8½ x 11, light blue color, dark blue printing $1

RTTY-DXDC

Frame and hang this one above your machine. An operating award for those who have submitted proof of 2-way teletype communications with 10 countries. Endorsement provisions for different bands. Dated and signed by Wayne Green, Editor and Publisher of 73 Magazine. Enclose postage for return of QSLs. 8½ x 11, light blue color, black printing, ... $1

CHC Certificate

Presented to those who submit a sworn statement that they have never received a certificate for radio operating and if they ever receive one, they will hate it. This certificate should be your first before you accidentally do something and receive a certificate for it. This attests to your membership in the Certificate Haters Club. Light purple, black printing, 8½ x 11 .....$1

BOOKS & STUFF

73

Fascinating World of Radio Communications	$4.00
Novice Class Study Guide	$4.00
General Class Study Guide	$6.00
Advanced Class Study Guide	$4.00
Extra Class Study Guide, reduced price	$5.00
VHF Projects for Amateur & Experimenter	$5.00
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How to Use FM, an introduction	$1.50
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*FM Repeater Circuits Manual	$5.00
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RTTY Handbook, radio teletype A to Z	$6.00
ATV Anthology, fast scan VHF TV	$3.00
*SSTV Handbook, new, only slow scan avail.	$5.00
Diode Circuits Handbook, galore	$1.00
73 Transistor Circuits, all useful	$1.00
Transistor Projects, mucho	$3.00
Solid State Projects	$4.00
IC Projects	$4.00
108 Q & A, transmitting, receiving, ant.	$2.00
TVI Handbook, why suffer	$1.50
Coax Handbook, cables & connectors	$3.00
DX Handbook, w/map	$3.00
World DX Map, wall size, rolled	$2.00
Custom DX Bearing Charts, beam headings	$4.00
U.S. Maps, for WAS, etc (4 ea)	$1.00
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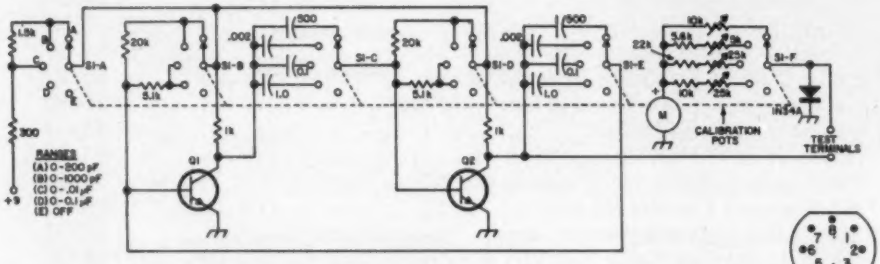
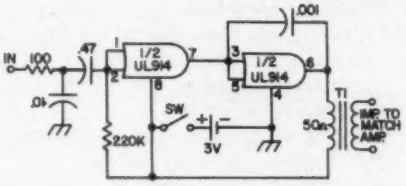
CIRCUITS, CIRCUITS, CIRCUITS...

The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

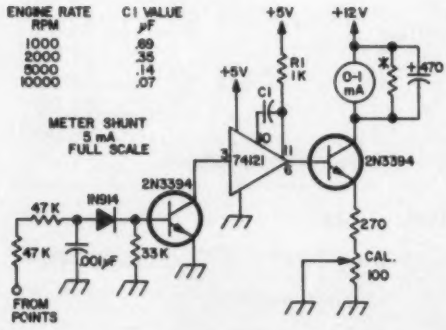
Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.



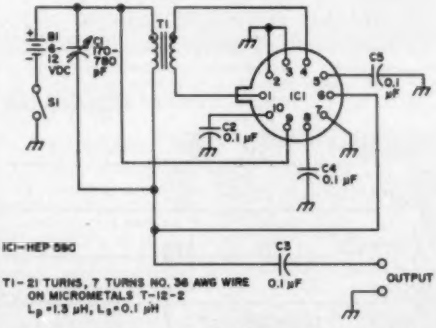
Although this capacitance meter will not measure electrolytic capacitors, it will measure any other type from zero to 0.1 µF with reasonable accuracy. On the lower end 4 pF can be read accurately and 2 pF easily estimated. Transistors Q1 and Q2 are 2N168, 2N1605, 2N2926, SK3011 or HEP-54; the meter is a 0–50 microampere unit and the range switch a Centralab PA1021.



A mike or phono amp using the UL914. Since the power requirements are minimal this is a good circuit to mount right in the microphone case along with two tiny batteries. Thanks to K5ITE.



An IC tachometer that is adaptable, by changing C1, to different rpm rates. In the event there is no other tachometer handy with which to calibrate the unit, temporarily disconnect the three components at the cathode of the 1N914 and connect it to a signal generator through a 5.6k resistor. From "Handbook of IC Circuit Projects," by Tab Books.



5–10 MHz VFO or 40 meter QRP transmitter; an idea for those backwoods hikes. Courtesy Motorola HMA36, IC Projects for Amateurs.

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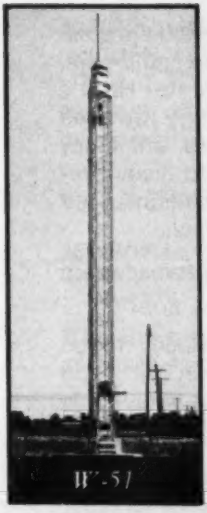

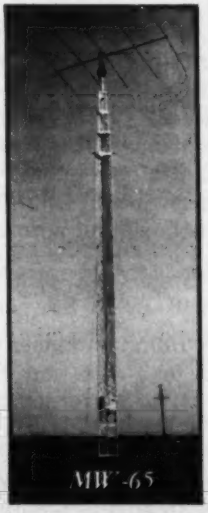

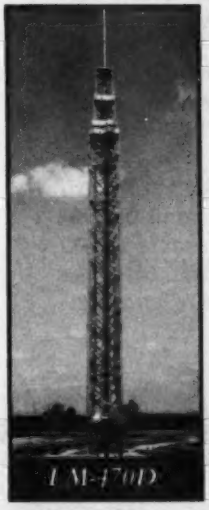

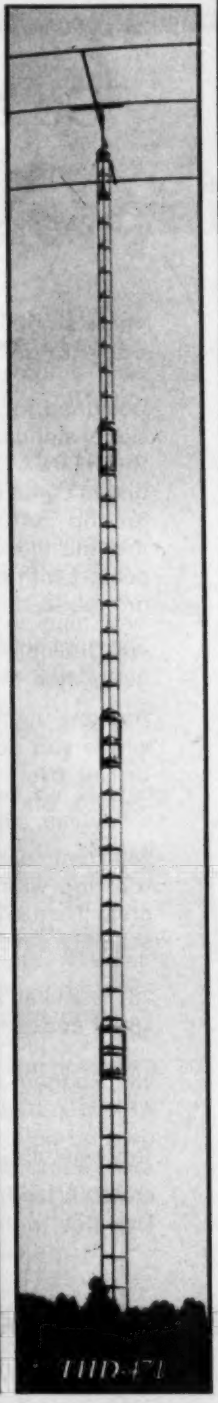

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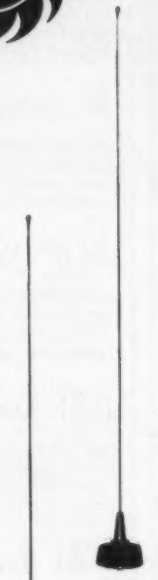

260

261

262

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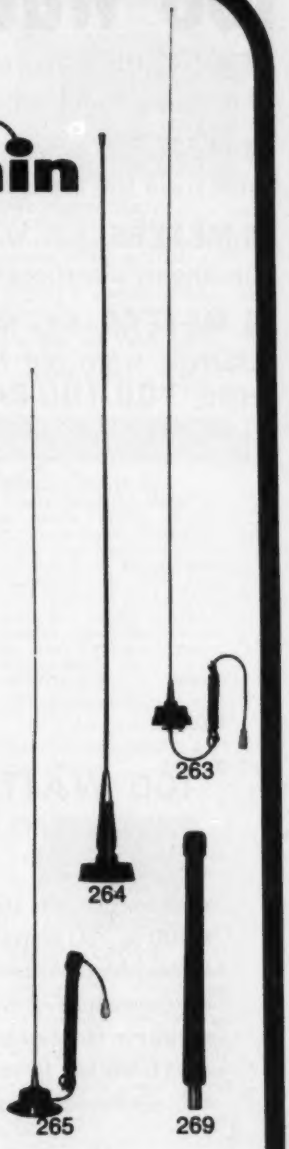

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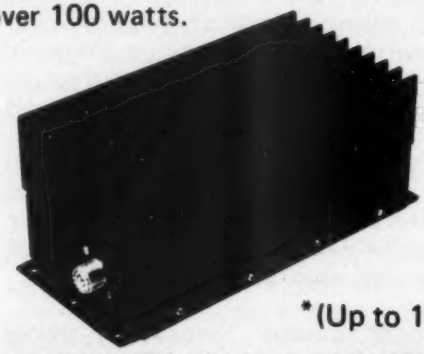

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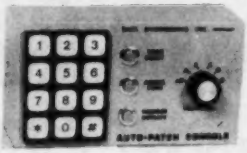

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In less than 15 minutes you can convert your portable transceiver to Touch-Tone operation.
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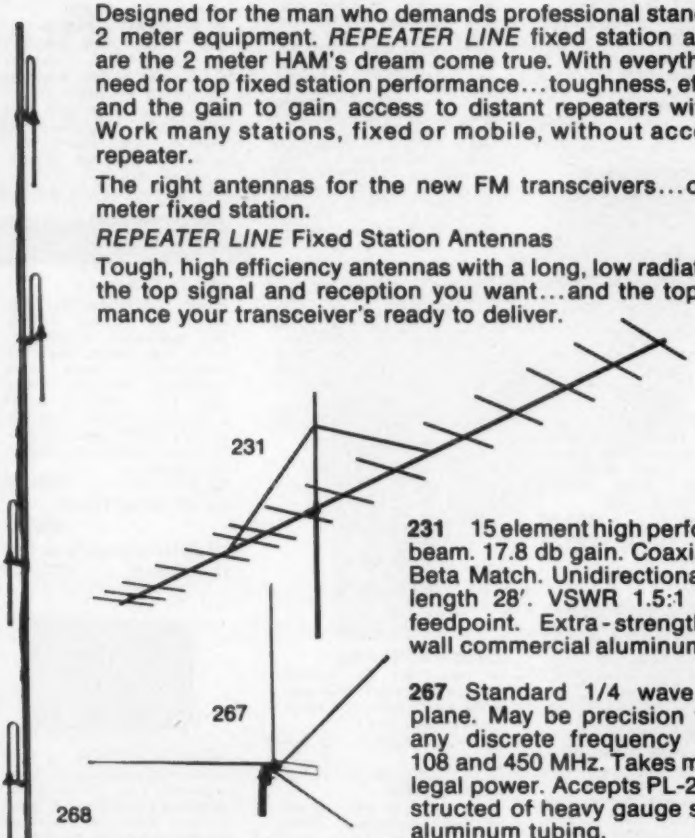

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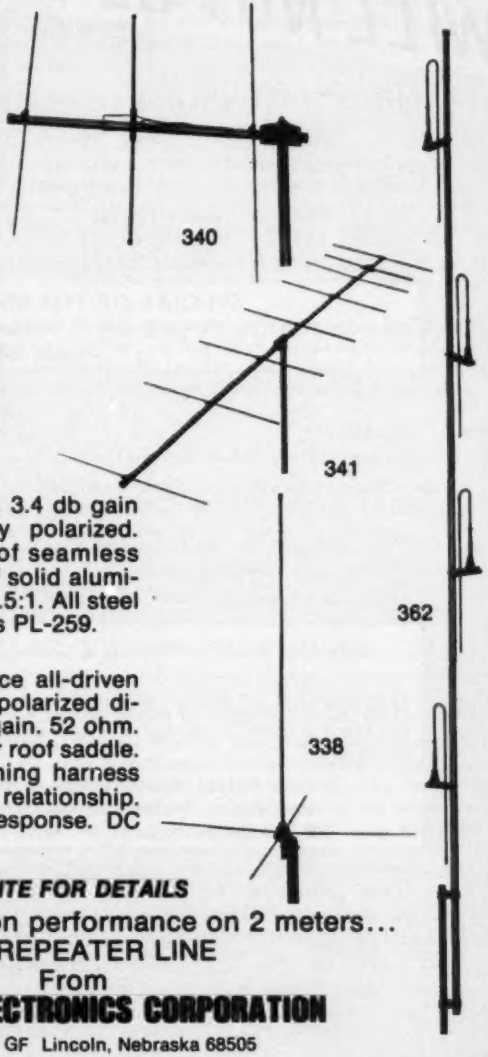

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74121	.60	.57	.54	.51
74122	.74	.71	.68	.65
74123	1.30	1.20	1.10	1.00
74141	1.75	1.66	1.57	1.48
74145	1.50	1.43	1.36	1.29
74150	2.00	1.85	1.70	1.55
74151	1.20	1.24	1.18	1.12
74153	1.70	1.60	1.50	1.40
74154	2.75	2.55	2.35	2.05
74155	1.56	1.49	1.42	1.35
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74157	1.56	1.48	1.39	1.31
74158	1.56	1.48	1.39	1.31
74160	2.20	2.10	2.00	1.90
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74162	2.20	2.10	2.00	1.90
74163	2.20	2.10	2.00	1.90
74164	2.20	2.10	2.00	1.90
74166	2.30	2.20	2.10	2.00
74173	2.00	1.90	1.80	1.70
74180	1.30	1.23	1.16	1.09
74181	5.20	4.90	4.60	4.30
74182	1.26	1.19	1.12	1.05
74192	2.10	2.00	1.90	1.80
74193	2.10	2.00	1.90	1.80
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74500	.88	.84	.79	.75
74501	.88	.84	.79	.75
74503	.88	.84	.79	.75
74504	1.00	.95	.90	.85
74505	1.00	.95	.90	.85
74508	.88	.84	.79	.75
74509	.88	.84	.79	.75
74510	.88	.84	.79	.75
74515	.88	.84	.79	.75
74520	.88	.84	.79	.75
74521	.88	.84	.79	.75
74522	.88	.84	.79	.75
74540	1.00	.95	.90	.85
74550	.88	.84	.79	.75
74551	.88	.84	.79	.75
74560	.88	.84	.79	.75
74564	.88	.84	.79	.75
74565	.88	.84	.79	.75
74573	1.82	1.73	1.63	1.54
74574	1.82	1.73	1.63	1.54
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NE550A	1.30	1.23	1.16	1.09
NE555V	1.10	1.05	1.00	.95
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NE556V	1.00	.95	.90	.85
NE560B	3.57	3.36	3.15	2.94
NE561B	3.57	3.36	3.15	2.94
NE562B	3.57	3.36	3.15	2.94
NE565A	3.57	3.36	3.15	2.94
NE566V	3.57	3.36	3.15	2.94
NE567V	3.57	3.36	3.15	2.94
N5111A	.90	.86	.82	.78
N5595A	3.40	3.20	3.00	2.80
N5596A	1.87	1.77	1.66	1.56
709V	.50	.47	.44	.41
710A	.50	.47	.44	.41
711A	.53	.52	.49	.46
725A	1.00	.95	.90	.85
730A	1.90	1.80	1.70	1.60
741V	.55	.52	.49	.46
747A	1.10	1.04	.98	.92
748V	.60	.57	.54	.51
LM335	2.85	2.72	2.64	2.35
LM336	3.85	3.66	3.46	3.27
LM337	4.05	3.70	3.51	3.31
TRANSISTORS AND DIODES				
1N270	.15	.14	.13	.12
1N914	.10	.09	.08	.07
1N4001	.10	.09	.08	.07
1N4002	.11	.10	.09	.08
1N4003	.13	.12	.11	.10
1N4006	.15	.14	.13	.12
1N747A - thru 1N758A	.25	.22	.19	.16
2N3860	.25	.23	.21	.19

All IC's are supplied in 8–, 14–, or 24–pin DIP (Dual-in-line) plastic or ceramic package except for NE536, NE540, and SE540 which come in TO–5 package. Voltage Regulators LM335, LM336 and LM337 are supplied in TO–3 (Diamond) package.

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SSS-4	7.75	7.50	7.00	6.75	6.50
SSS-7	3.50	3.25	3.00	2.75	2.50
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16 Pin)	.60	.55	.50	.45	.35
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100μF, 15V	$.10	500μF, 35V	$.40	50μF, 50V	$.20
220μF, 15V	$.15	1000μF, 35V	$.50	100μF, 50V	$.20
500μF, 15V	$.20	1μF, 50V	$.10	200μF, 50V	$.40
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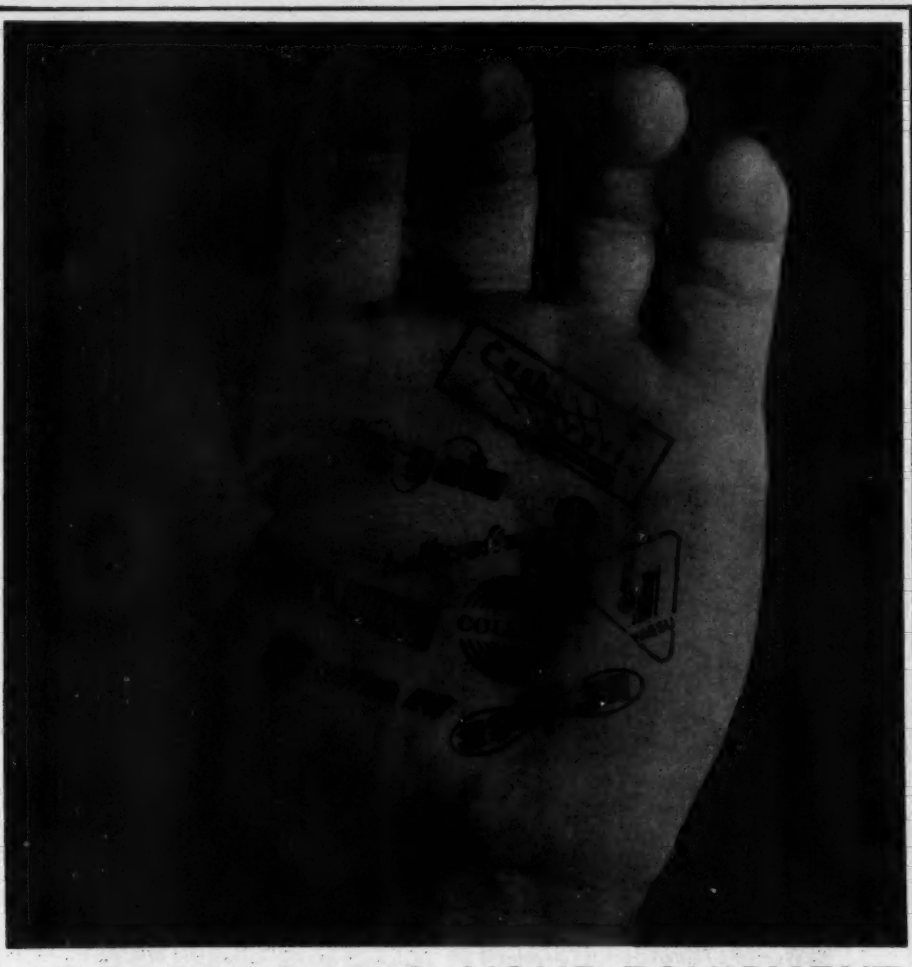

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If you have been putting off building because of circuit board layout; you have no problems ..... just send a schematic to PEMCO and we will design and build your circuit board to your specs using high quality G10-FR4 2 oz. copper and tin plated for long resistance to oxidation.

"INTRODUCTORY PRICES"

SC 250 8 DIGIT COUNTER with built in prescaler, and p.s. good up to approx. 250 MHz. Fully assembled and tested board, only $165.

Send for data.

ST-5 BOARD ONLY	$ 5.25
ST-5 KIT OF ELECTRONIC PARTS	$ 47.50
ST-5A BOARD ONLY	$ 5.25
ST-5A KIT OF ELECTRONIC PARTS	$ 54.00
ST-6 BOARD ONLY (These are the 8 original by W6FFC)	$ 18.00
ST-6 KIT OF ELECTRONIC PARTS	$128.50
MOD. KIT FOR UPDATING THE ST-5 TO THE ST5A	$ 9.00
AK-1 BOARD ONLY	$ 3.25
AK-1 KIT OF ELECTRONIC PARTS (Same size as those in the ST-6)	$ 20.00
PEMCO MODEL 50A FREQUENCY COUNTER SEMI-KIT	$125.00

This is a fully assembled and tested board with built-in power supply, cabinet, etc. Write for details.

You must supply the cabinet, A.C. cord, meter, switches, etc. on all kits except where noted otherwise. (All prices are postage paid — we pay shipping.)

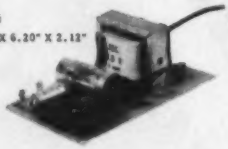
We will do most any printed circuit board for individuals or prototypes. If required we will also do the layout of the boards. All our boards are G-10 glass-epoxy solder plated and come drilled only. At present time we can do only single sided. All component parts used in our kits are new manufacturers stock. We Do Not Use Any Used or Surplus Parts. All inquiries are answered promptly.

PEMCO Inc. ELECTRONICS MANUFACTURING

422 18th St., N.E., Salem, Ore. 97301, (503) 585-1641

NEW and SURPLUS ELECTRONICS FOR THE HAM and EXPERIMENTER

SIZE: 3.55" X 6.20" X 2.12"



5 VDC 3/4 AMP POWER SUPPLY KIT

12.95

USES THE LATEST STATE-OF-THE-ART THREE TERMINAL REGULATOR CIRCUITRY.

HAS INTERNAL CURRENT LIMIT, THERMAL SHUTDOWN, AND SAFE-AREA COMPENSATION.

Greatest advance in soldering since electricity...

$19.95

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COMPLETELY PORTABLE

HEATS IN 8 SECONDS

SOLDERS UP TO 150 JOINTS OR MORE PER CHARGE

RECHARGES AUTOMATICALLY IN ITS OWN STAND

NO AC LEAKAGE OR INDUCED CURRENT TO DAMAGE DELICATE ELECTRONIC COMPONENTS.

COMPLETE WITH RECHARGING STAND, FINE TIP AND INSTRUCTION BOOKLET

ALPHA-NUMERIC KEYBOARD

$50.00

MICRO SWITCH

MODEL SW-10639 contains 61 #15W11 Solid-State switches including key tops, ROM encoded into EBCDIC.

MODEL KW-01135 contains 56 #7A1MS Reed switches including key tops, diode encoded into EBCDIC.

DIP CLIP® IC TEST CLIP

POMONA ELECTRONICS

MODEL 3915

4.95

FOR 14 OR 16 DUAL-IN-LINE PACKAGES

The "Dip-Clip" is specially designed to allow the attachment of test probes to 14 or 16 lead DIP's. The unique design greatly reduces the possibility of accidental shorting while testing live circuits. Numerous test probes may be quickly connected for hands-free testing.

MOS DIGITAL CLOCK CHIP

$14.95

Four digit electronic clock LSI circuit in 40 pin DIP. Designed for direct output to Liquid Crystal Display. Internal options include: Alarm, Snooze, Seconds Display, Reset, and 24 hour operation.

CREST POWER STRIPS

WITH: FUSE, SWITCH, AND LAMP

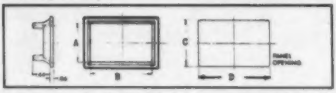
$9.30

$14.70

MODEL 11 Other Models Available MODEL 12

NOBEX DIGIBEZEL

alpha-numeric display bezels



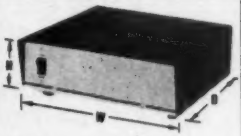
MODEL	DIMENSION 'A'	'B'	'C'	'D'	PRICE 1-24	25-99	100-UP
905-XX	.80	1.37	1.172	1.74	$2.25	2.07	1.91
910-XX	.80	2.00	1.172	2.37	2.30	2.12	1.95
915-XX	.80	3.00	1.172	3.37	2.40	2.21	2.04
920-XX	.80	4.00	1.172	4.37	2.45	2.25	2.08
930-XX	1.38	5.00	1.750	5.37	2.75	2.53	2.33
940-XX	.80	5.58	1.172	5.95	2.65	2.43	2.25
950-XX	1.38	6.90	1.750	6.87	3.15	2.89	2.67

WHEN ORDERING REPLACE XX WITH FILTER COLOR CODE:

NEUTRAL = 15, RED = 60, AMBER = 70, GREEN = 90

example: 930-60 (Model 930 with RED Filter)

BOSS BOXS



Deluxe Electronic Equipment Enclosures

MODEL	DIMENSIONS W. H. DEPTH	Screen Viewed	RESALE NET
"A"	9¾ x 3½ x 9	no	2.75
"B"	9¾ x 3½ x 9¾	no	4.50
"C"	7¼ x 3¾ x 6	Yes	5.95
"D"	9 x 7½ x 8 (models avg. avail.)	Yes	8.75
"E"	9½ x 7¾ x 7¾	Yes	8.25
"F"	7½ x 4½ x 10	Yes	9.95
"G"	10¾ x 5¾ x 9	Yes	9.95
"H"	4¾ x 6½ x 4	no	5.95
"201"	Mtg. bracket set for "G"		.50
"H"	"H" Panel with mounted Wide Vue meter, 3½" D-1 ma DC & 2 Rocker switches		10.95
"HA"	8 1/8 x 5 1/2 x 4 (Blank Panel)		8.95
"J"	8 x 3 1/2 x 5 3/4 (Sloping Panel)		7.45
"K"	4 3/4 x 7 3/8 x 11 W/Handle		13.50
"L"	11 1/8 x 6 1/8 x 12 3/4		20.50
"M"	11 1/8 x 6 1/8 x 16 3/4		21.50

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HUNTER TOOLS EMICO STEWART-WARNER CORPORATION

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Numitron 5V 7-Segment
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GE Y 4075 25V Miniature **$1 75**

GE Y 1938 24V Standard **$1.75**

RAY CK 1905 Standard **$1.75**

MAN-3 1.7V Miniature **$3.50 ea. 10/$30**

GIANT ALPHA NUMERIC

B7971 **$1.00**

OIL CAPS 16 MFD 5000 VOLT

Rare find. $9.00 each 3 $25.00

NOISE ACTUATED SWITCH $1.35

Solid state noise actuated switch fully wired, includes mike pick-up, amplifier, SCR switch. Actuates by noise or whistle. Useful for burglar alarms, lamp lighter, etc. 15 ft range.

LIGHT EMITTING DIODES 3/$1.00

Ruby red, gold plated leads. With mercury cell for instant testing.

H.H. SCOTT MULTIPLEX

Solid state brand new multiplex module w/ schematic. Possibility of conversion of various mono sets to stereo. $3.00 each 10 for $25.00

Alpha-numeric keyboards. Excellent to new in condition. Styles may vary slightly from picture. Two models available, one with ASCII encoder in base $55.00 postpaid in the U.S. Keyboard with no encoder in base $35.00 postpaid in U.S.

KEY BOARDS
$35.00 & $55.00

RCA MEMORY STACK 32x32x9

3rd generation, ultra compact. Measures 1x4 1/4x7. Brand new. $50.00 3 for $125.00

CORE STACK

Late model memory stacks, unused,

1Kx9 ..... $35.00
2Kx9 ..... 50.00
8K 4 bit Y-plane 40.00
16K 4 bit Y-plane. 60.00
147K stack 100.00

URC-11 WALKY TALKY

243 MC 2 way radio, hand held, measures 3x4 inches. Used for survival in downed aircraft. May be converted for other frequencies. URC-11 $15 each or 3 for $40.00

15 AMP BATTERY CHARGER

Brand new GE transformer, 25 amp fullwave bridge. Output approximately 15 volts up to 15 amps. Ideal battery charger or DC source for general use. With instructions, assembled in minutes.

PK–4 **$7.50**

7 SEGMENT LED

Hobby craft due to being factory rejects. Most have a segment or decimal inoperative. Still a great "buy" for the experimenter. What an unusual tie clip you can make with pocket battery . . . demo displays, etc. In many applications you don't need full 7 segments. $1.00 each or $10 the dozen. 0.333 inches high character.

12VDC 3 AMP POWER KIT $5.00

Just right for powering car tape deck, CB sets, car radio, etc. from regular house current. We furnish parts – transformer, silicon bridge, filtering caps, directions. All new parts, order #KT-3 at $5.00 ea or 6 for $25.00

GIANT 7 SEGMENT

As above only this one is the giant display 13/16 inches hgt of character. First time offered and as far as we know, offered nowhere else. This one is quite an attention getter. Also available in this giant display numeral "one" with "plus" and "minus" sign. Again, these are rejects. Giant display $1.50 each 12 for $15.00

Meshna

Postage extra on above. **MESHNA PO Bx 62 E. Lynn Mass. 01904**

6 METER

The *NEW* **Excello Six Meter Transmitter** is the *FINEST TRANSMITTER* in the VHF field today!

All circuits are stressed to the fullest output to give **Full Drive** to the next stage and final output.

Modulation is pure and full using the **Finest American Parts** and **American Labor. Shielding** is used between each stage.

Net Price to Amateurs
Complete with Tubes
Less Power Supply
$9.95 Solid State

$49.95

- **Base Station**
- **Mobile**
- **Aircraft**
- **Boats**

Tube Compliment
6U8 OSC
2E26 Final
12AX7 Speech Amp.
6BQ5 Modulator

EXCELLO EX20S
Dealer Inquiries Invited

2 METER

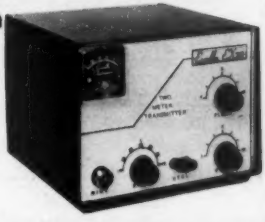
Now you can QSO all over your local community with the *NEW* **Excello Two Meter AM Phone Transmitter!**

Either **Fixed Mobile** or **Portable,** enough power to QSO yet **No TVI.** Unit **Small** and **Compact,** enclosed in a perforated steel case to prevent TVI and feedback.

Net Price to Amateurs
Complete with Tubes
Less Power Supply
$9.95 Solid State

$59.95

- **Base Station**
- **Mobile**
- **Aircraft**
- **Boats**



Tube Compliment
6BA8 Osc-Mult.
6CX8 Final Amp.
6AQ5 Modulator
12AX7 Speech Amp.

NOVICE-CW

80-40 METER

The *NEW* **Excello CW Novice Transmitter** is *THE ANSWER* to the New Amateur getting on the air and enjoying the *GREATEST OF ALL* hobbies!

The New Excello Novice CW Transmitter puts out a **Fine CW Signal** on the air. The unit is **Small** and **Compact** and **Complete with Built-in Power Supply, Tubes,** less crystals and key.

Net Price to Amateurs
Complete F.O.B. N.Y.

$49.95

See Your Dealer

Tube Compliment
5763 OSC
6L6 Final Amp.
1-40 Meter Coil
1-80 Meter Coil

We have moved to our new 7000 sq. ft. facilities

Ship To_____ Bill To_____

Street No._____ Address_____

City & State_____ Total Price_____

Model No._____

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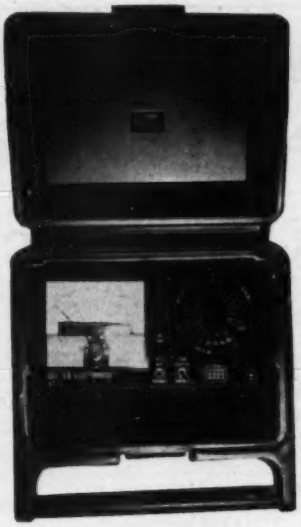
Phone 212-276-7697

ERL

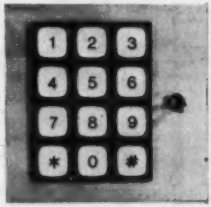


UT–1

Portable Tune Up Meter with cables to plug into Motorola, Link, GE, Standard, etc. This unit gives you the meter functions of the radio being tested. It also operates as a portable dc voltmeter with the following full scale ranges: 1.5, 5, 15, 50, 150, 500, 1 KV with a special 3 volt range for GE Progress Line equipment. The UT-1 can be set zero center for discriminator readings. Also featured in the UT-1 is a field strength meter. Place your order now. Kit form **$42.50**. Wired **$49.95**. Extra cables of your choice (specify rig) . **$5.00 ea.**

($2.00 for postage and handling.)

TESCO–PAD



The "TESCO–PAD" has no tuned coils to go off frequency, no tuning necessary or even there! It's all in one "Black Box I.C." ready to go. The "TESCO–PAD" has a 1 second hold-up for your transmitter, complete P.T.T. operation, available with dual audio output levels, 12 or 16 tone combinations.

KIT $34.95 **$39.95 Wired**

(Add $1.00 for 16 tone version)
($2.00 for dual output version)

(Add $1.00 for postage and handling.)

Waller Electronics - Test Equipment Sales

P.O. Box 9913, Chevy Chase, Md. 20015 Telephone: 301-652-0996

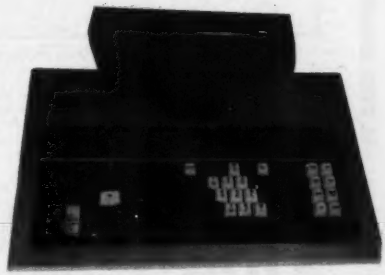
Late Type SURPLUS

Computer Keyboard Terminals

New terminals include 88 character EBCDIC keyboard, I.C. decoder & control boards, display with 3 digit numeric readout and alpha-numeric Burroughs readout

WERE 125.00 NOW **$85.00**

w/schematic while supply lasts!



R394U 150–174 MHz receivers (FM) special . . . . . $15.00 ea.

12V 8 amp Power Supply Kits $8.50

RTTY Polar Relays . . . . . $1.50 ea.

New ribbon cable . . . $.20/ft . . . $15.00/100 ft (20 cond.)

36 cond . . . $.30/ft . . . $22.00/100 ft

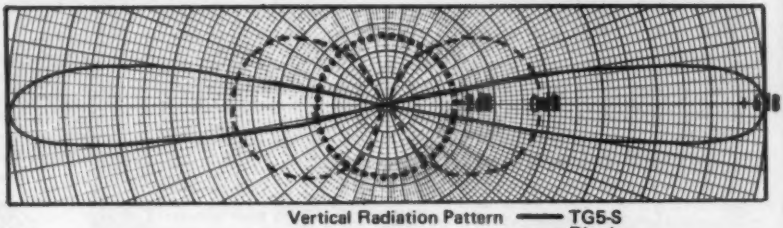
Super Low CMOS PRICES

Send for our FREE Catalog!

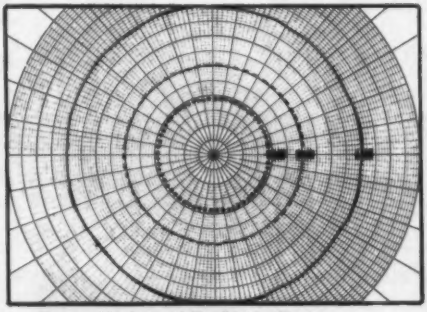
Surplus Electronics
10518 Connecticut Ave.
Kensington, Maryland
20795

GAM has what your repeater needs

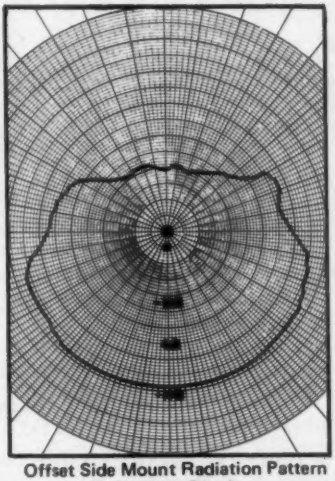
8.2 dB GAIN OVER ISOTROPIC



Vertical Radiation Pattern — TG5-S, Dipole, Isotropic



Horizontal Radiation Pattern
TG5-S
Dipole
Isotropic



Offset Side Mount Radiation Pattern
Reference: Dipole

(ON FILE WITH FCC)

MODEL TG5-S

$104.50 LIST PRICE

Weight 3½ lbs.

G·A·M Electronics

191 VARNEY STREET
MANCHESTER NH 03102
TEL. (603) 627-1010

CT5005 CALCULATOR

This calculator chip has a full four function memory, which is controlled by four keys, +M (adds entry into memory), -M (subtract entry from memory), CM (clear memory---without clearing rest of registers), RM (read memory or use as entry).

12 digit display and calc.
fixed decimal at 0,1,2,3,4, or 5
leading zero suppression
seven segment multiplexed output
true credit sign display
single 20 pin chip

Chip and data----------$14.95
Data only (refundable)-------- 1.00

MAN3M Each.....$ 2.50
Ten or more..20.00

'73' SPECIALS

each $ 3.00
10 for 25.00 MAN4

KEYBOARD **General Telephone** $5.95

Ten push buttons (0-9) touch-tone, encoding, programming devices. Easy for panel mounting. Size: 3X2½X1"

LED's

MV-50 red emitting 10-40ma@2V $.39

MV5020 red LED .45

MV-10B Visible red 5-70ma @ 2V .45

RECTIFIERS

Varo Bridges

VS447	2A	400V	$ .90
VS647	2A	600V	1.10
35A	Stud	400V	1.10

MR810		50V 1A	.10
1N4997		50V 1A	.10
1N4001		1A	.10
1N4002		1A	.11
1N4003		1A	.12
1N4004		1A	.13
1N4007		1A	.17

SCR's

IR122	100V 8AMP	.50
IR122	200V 8AMP	.60
IR122	300V 8AMP	.80
IR122	400V 8AMP	1.00

All IC's are new and fully tested leads are plated with gold or solder Orders for $5 or more will be shipped prepaid. Add 35¢ for handling and postage for smaller orders, residents in California add sales tax. IC orders are shipped within two workdays of receipt of order-kits are shipped within ten days of receipt of order. $10.00 minimum on C.O.D.'s (phone in). (916) 9662111

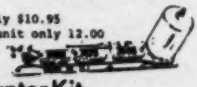
BABYLON ELECTRONICS
P.O. Box J
Carmichael
California
Zip--95608

MONEY BACK GUARANTEE on ALL GOODS...

CD-2 Counter Kit

This kit provides a highly sophisticated display section module for clocks, counter or other numerical display needs. The unit is .9" wide and 4 3/8" long. A single 5 volt power source powers both the IC's and the display tube. It can attain typical count rates of up to 30 MHz and also has a lamp test, causing all seven segments to light. Kit includes a two sided(with plated through holes) fiberglass printed circuit board, a 7490, a 7475, a 7447, a DR2010 RCA Numitron display tube, complete instructions, and enough Molex pins for the IC's.....NOTE, boards can be supplied in a single panel of up to ten digits (with all interconnects) therefore, when ordering please specify wether you want them in single panels or in one multiple digit board Not specifying will result in shipping delay

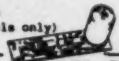
Complete kit, only $10.95
Fully assembled unit only 12.00



CD-3 Counter Kit

Can be programmed to count to any modulus--2-9 for one kit, 2-99 for two kits, etc. Includes everything as in CD-2, two resistors, three diodes, but is without the 7475 quad-latch. Full instructions included----perfect for displaying seconds, minutes, hours, etc.

Complete kit, only $9.95
(supplied in single panels only)



8000 series TTL DIP

8200	4 bit comparator	$1.60
8210	8 line to 1 line selector	1.40
8220	parity generator/checker	1.00
8223	256 bit programmable ROM	7.50
8230	8 input multiplexer	2.00
8233	2 input 4 bit multiplexer	1.75
8242	4 bit comparator	1.15
8251	BCD to decimal decoder	1.00
8261	fast carry extender	2.00
8266	2 input 4 bit multiplexer	1.50
8270	4 bit PI, SI, SO	2.00
8271	4 bit shift register	2.00
8274	10 bit PI, SO register	3.00
8281	45MC presetable binary counter	1.15
8290	presetable decade counter 75MC	3.50
8292	presetable decade counter 10MC	1.15
8520	25MC divide by "N" 2 to 15	2.00
8551	tri state quad latch	2.50
8570	8 bit SI, PO	3.00
8590	8 bit PI, SO	2.00
8275	quad bistable latch	.90

LINEARS

NE531	op amp TO-5	$2.00
NE560	phase lock loop DIP	3.25
NE561	phase lock loop DIP	3.25
NE565	phase lock loop TO-5	3.25
NE566	function generator TO-5	4.00
NE567	tone decoder TO-5	4.00
NE5556	op amp DIP	1.00
709	popular op amp DIP	.45
710	voltage comparator DIP	.50
711	dual comparator DIP	.40
723	precision voltage regulator DIP	1.00
747	dual 741 op amp DIP	1.00
748	op amp TO-5	1.00
LM100	positive DC regulator TO-3	1.00
LM102	op amp voltage follower TO-5	1.25
LM308	op amp TO-5	2.00
LM311	comparator TO-5	1.75
LM380	2W audio amp DIP	1.75
LM703	RF-IF amp epoxy TO-5	1.00
LM309H	5V-200ma power supply TO-5	1.00
LM309K	5V-1A power supply module TO-3	2.00

Silicon diodes (signal) only.
1 foot (60) diodes $2.50

EPOXY TRANSISTORS

TO-5 and TO-18 mixed 1 ounce (40+)-----$1.00

1 amp Silicon Rectifier
minimum 200 PIV many such higher, comes in unbranded epoxy case (fully tested)
15 for $1.00

MOS by NATIONAL

Dynamic shift registers TV-5 only

MM502	dual	50	BIT	$1.25
MM506	dual	100	BIT	1.75
MM5006	dual	100	BIT	1.50
MM5013		1024	BIT	2.25
MM5016		512	BIT	1.50

Static shift registers

MM504	dual	16	BIT	1.50
MM505	dual	32	BIT	1.75
MM550	dual differential analog switch			2.50

CMOS

CD4001	quad 2-input	$ .75
CD4002	quad 4-input	.75
CD4012	dual 4-input	.75
CD4023	triple 3-input	.75

DR2010 by RCA

A popular Numitron digital display tube. This incandescent five volt seven segment device provides .6" high numeral which can be seen at a distance of 30 feet. The tube has a standard nine pin base (solderable) and a left hand decimal point.

$5.00 each
$4.00 each for 5 or more

7400 series DIP

7400	$ .35	74H53	.50
74H00	.50	7454	.35
7401	.35	74L54	.50
74H01	.50	74L55	.50
7403	.35	7460	.35
7404	.35	74L71	.30
74L04	.50	7472	.50
74H04	.50	74L72	.60
7405	.35	7473	.65
74H05	.50	74L73	.90
74H08	.50	7474	.65
7410	.35	74L74	.90
74L10	.50	74H74	.90
74H11	.60	7476	.70
7413	1.15	74L78	1.00
7420	.35	7480	.65
74L20	.50	7483	1.30
74H20	.50	7486	.80
74H22	.80		
7430	.35	7490	1.50
74L30	.50	7491	1.15
7440	.35	7492	1.15
74H40	.50	7493	1.15
7441	1.60	7495	1.25
7442	1.30	74L95	2.00
7446	1.75	74107	.70
7447	1.75	74121	1.60
7448	1.15	74123	2.00
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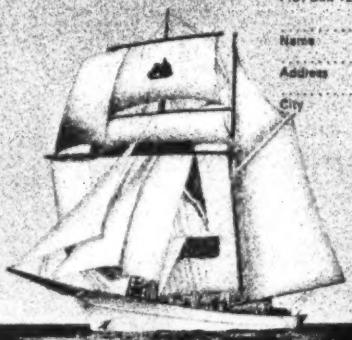

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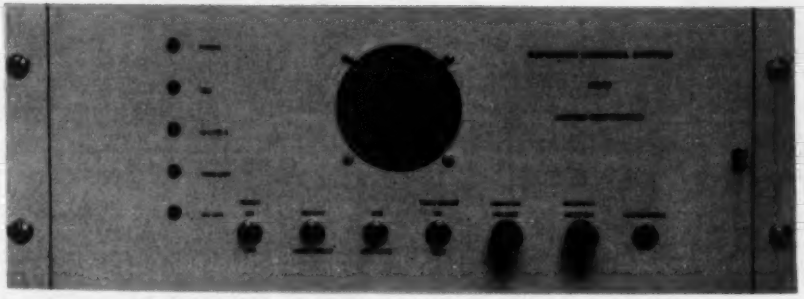

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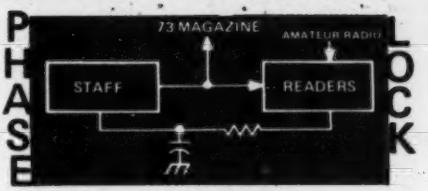

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- ☐ Fair 29
- ☐ Freck 30, 113
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- ☐ Gregory 56
- ☐ Ham Radio Ctr. 30
- ☐ Hamtronics 52, 53
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CANAL ZONE	14	14	7	7	7	7	7A	14	14	14	14	14A
ENGLAND	7	7	7	7	7	7	7A	14	14	14	14	14
HAWAII	14	14	7B	7	7	7	7	7	7A	14	14	14
INDIA	7	7	7	7B	7B	7B	14	14	14	14	7B	7B
JAPAN	14	7A	7	7	7	7	7	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	7A	14	14	14	14
PHILIPPINES	14	14	7B	7B	7B	7B	7	7	7	7	7A	14
PUERTO RICO	14	7	7	7	7	7	7	7	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	14	14	14	14	14	14	7B
U. S. S. R.	7	7	7	7	7	7	14	14	14	14	14	7B
WEST COAST	14	14	7	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	14	7	7	7	7	7	7	7	7	7A	7A
ARGENTINA	14	14	14	7	7	7	7A	14	14	14	14	14A
AUSTRALIA	14	14	14	7B	7B	7	7	7	7	7	14	14
CANAL ZONE	14A	14	7	7	7	7	7	14	14	14	14	14A
ENGLAND	7	7	7	7	7	7	7	7	14	14	14	14
HAWAII	14	14	14	7B	7	7	7	7	14	14	14	14
INDIA	7A	7B	7	7	7B	7B	7B	7B	14	14	14	14
JAPAN	14	14	7A	7	7	7	7	7	7	7	7A	14
MEXICO	14	7	7	7	7	7	7	7	7	14	14	14
PHILIPPINES	14	14	7A	7B	7B	7B	7B	7	7	7	7A	14
PUERTO RICO	14	7	7	7	7	7	7A	14	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	7B	14	14	14	14	14	7B
U. S. S. R.	7	7	7	7	7	7	7	7A	14	14	14	7B

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ARGENTINA	14	14	14	7	7	7	7	14	14	14	14	14A
AUSTRALIA	14	21	21	14	7A	7	7	7	7	7	14	14
CANAL ZONE	14A	14	7	7	7	7	7	14	14	14	14	14
ENGLAND	7	7	7	7	7	7	7	7	7	7A	14	14
HAWAII	14A	21	21	14	7	7	7	7	7	14	14	14
INDIA	14	14	14	7B	7B	7B	7	7	14	14	14	14
JAPAN	14	14	14	7A	7	7	7	7	7	7	14	14
MEXICO	14	14	7A	7	7	7	7	7A	14	14	14	14
PHILIPPINES	14	14	14	14	7B	7V	7	7	7	7	14	14
PUERTO RICO	14	14	7	7	7	7	7	7A	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	7B	7B	7B	14	14	14	7B
U. S. S. R.	7	7	7	7	7	7	7	7	14	14	14	7B
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B = Difficult circuit this period.

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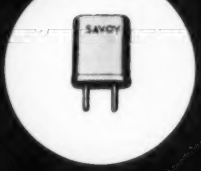

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